
Indiana Bureau of Motor Vehicles

IS21 Phase I Technical Architecture Report November 12, 2002



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TECHNICAL ARCHITECTURE REPORT

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1 Overview

This document describes the Technical Architecture required to support the implementation of the IS21 application for the Indiana Bureau of Motor Vehicles.

The BMV established the following goals for the Technical Architecture for IS21 project:

1. Support All Application Requirements
The selected technologies must be able to support all defined requirements of the IS21 system.
2. Minimize Support Efforts
The selected technologies should minimize the required support efforts by addressing a number of areas:
 - Reduce the need to distribute software to workstations
 - Provide centralized support capabilities
 - Use standard hardware components wherever possible
3. Deliver a Highly Reliable Solution
The selected technologies should provide a highly reliable solution by minimizing downtime and outage interruptions, and by reducing the time required to recover from each outage.
4. Use Open Technologies
The selected technologies will provide a technical environment that is easily interfaced with the technologies of other agencies and organizations.

Skills to support the selected technologies will be readily available from multiple sources.
5. Support Overall State of Indiana IT Strategies
6. Can Be Supported by BMV and DoIT Resources
7. Provide a Cost-Effective Solution

2 Application Architecture

2.1 Description

The IS21 application will be delivered to the end users of the system using a web browser. It will use a relational database, and will be developed using a multi-tier application architecture based on Microsoft's .NET. .NET is an open tools platform that extensively leverages open technologies and standards such as XML and SOAP. Information about the .NET environment can be found at <http://www.microsoft.com/business/whitepapers/net/net.asp>. Additional content from this site can also be viewed in [Appendix A](#) of this document.

2.2 Multi-Tier Architecture

The application architecture used for the IS21 application will have three tiers. The tiers are the user interface, the application services, and the database services.

2.2.1 User Interface (Presentation)

The user interface is the first tier of the application architecture. It is sometimes referred to as the *presentation tier*. The design goal for this tier is to keep it as "thin" as possible. This means minimizing the amount of processing done on the client side, with the main emphasis on delivering the screens to the user. The IS21 application will use an Internet browser as the primary user interface. Development will target the most currently released version of Microsoft's Internet Explorer at the time development begins (most current release at this writing is 5.5). HTML documents will be served to the browsers using Microsoft's Internet Information Server v5.0 running on Windows 2000 Servers. The HTML documents will be generated by the .NET-enabled web servers (ASP.NET or Active Server Pages for .NET) based on the user interface as designed using Visual Basic and Visual Studio.NET. These documents will be linked to applications hosted on other servers (application tier) using ASP.NET. The user interface will be enhanced using client-side scripting and client-side components written using JavaScript, VBScript, VB components, and/or DHTML. The application help will be delivered using links that access HTML help documents stored on the web servers (See Section 9 for more details about "User Help & Documentation").

The User Interface tier of the application and the Application Services tier of the application will be deployed on a number of load-balanced Web Services servers for internal users, but will be separated for non-internal and/or public users.

2.2.2 Application Services (Business Logic)

The middle tier of the application architecture is the application services. This tier processes the business logic of the application. In most cases, components in this tier will be written using Visual Basic. The use of COBOL components may be used for non-permanent components as a training exercise for MVIS staff. The use of C++ components may be necessary to incorporate third party software components. Application components will be Web Services generated by the Visual Studio.NET

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development environment and will be COM+ compliant (the object model native to Windows 2000). Components will communicate to the Presentation and Database layers using COM+, XML or OLEDB/SQL commands. Application components will be deployed and managed on Windows 2000 Application Servers, using the Application Services Manager. Application components will interface to the database services utilizing SQL commands implemented using Active Data Objects (ADO). Connections to database services will be made using OLEDB connections. Financial Transaction Verification Services (for credit card verification, debit card verification, and check verification) will be enabled using XML.

2.2.3 Database Services

The third tier of the application architecture is the database services. Isolating database services to their own tier allows development of an application that is largely database independent, limiting the amount of work effort required to move to a different database. The database selected for the IS21 application will be SQL Server 2000 running on Windows 2000 Servers. Stored procedures will be used when appropriate, and will be developed using the database's native stored procedure languages and tools. Under the phased developed approach used for IS21, it will be necessary to process data between the current mainframe and the IS21 database. The mainframe data retrieval and storage will be done using existing CICS transactions. These transactions will be accessed using Host Integration Server 2000, which exposes CICS transactions as Com+ components. Host Integration Server 2000 is the follow-up release to Microsoft's SNA Server. Host Integration is a comprehensive gateway and application integration platform that provides the best way to embrace Internet, intranet, and client/server technologies, while continuing to utilize mainframe-based systems.

2.3 Reporting

2.3.1 Defined Application Reports

IS21 will have several pre-defined application reports. These reports will be developed using Crystal Reports. Crystal Reports deploys over the web reports that have interactive content obtained from the transactional database or data warehouse. The reports are deployed using Crystal Reports runtime web services.

2.3.2 Ad Hoc Reporting

Ad hoc reporting is also a requirement of the IS21 application. Ad hoc reporting refers to production of informal reports on an "as needed" basis. Typically, these requests are done by an end user, rather than going through the formalities of requesting a report from a central data services department. Crystal Reports provides ad hoc reporting tools. The complex database structure of the IS21 application does not lend itself well to ad hoc reporting by non-technical individuals. To address this issue, data will be transformed into a data warehouse for reporting purposes.

2.3.3 Data Warehouse

A data warehouse is an integrated store of information collected to allow organizations quick access to key business data for purposes of improved decision-making and data analysis. Data in the warehouse can be derived from multiple, diverse systems. Typically, the information in a data warehouse is organized around the major subjects of the enterprise (for example, customers, products, sales, or vendors). Development of the warehouse is not a one-time effort. Based on feedback from users, the structure and content of the data warehouse changes over time. This helps assure that the data collection has the right content for the right people at the right time. Data warehousing has traditionally been viewed as a time-consuming and costly undertaking. However, current tools provided with SQL Server 2000 provide much quicker and less costly data warehousing capabilities. The data warehouse can include data from almost any data repository.

3 Organizational Roles

3.1 Background

The purpose of this section is to describe the roles required by BMV and DoIT to support the IS21 application. Roles do not necessarily represent an individual or group of individuals. A single person or a single group could carry out multiple roles, just as a single role may require a group of individuals. When appropriate, the role description includes the technology and tools required for that role.

The roles described below are based on the business decision that DoIT will support the infrastructure for the IS21 application. This includes hosting and supporting all server hardware and all back office software. DoIT will support the production server farm, as well as those BMV servers required for development and transition testing.

BMV will be responsible for the ongoing maintenance of the IS21 application and all support directly related to the application itself.

3.2 Future Role Requirements

3.2.1 BMV Role Requirements

Table 3.1: BMV Roles

Role	Description	Tools/Technology
Developer	Maintain and enhance IS21	Visual Studio Visual Source Safe Visual Basic SQL T/SQL VBScript Java Script COM+ HTML DHTML XML Crystal Reports
Analyst	Analyze enhancements for IS21	System analysis techniques for multi-tier applications SQL T/SQL
Data Analyst	Analyze uses of and changes to data warehouse	Data warehousing OLAP tools SQL T/SQL

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Role	Description	Tools/Technology
Database Analyst	Analyze changes to the database	SQL Server 2000 Database administration skills
Documentation		
Policies	Document the policies for BMV	Microsoft Word SharePoint document mgmt HTML
Procedures	Document the procedures for BMV	Microsoft Word SharePoint document mgmt HTML
Technical docs	Prepare technical documentation	Microsoft Word SharePoint document mgmt HTML
On-line help	Maintain and create on-line help features of IS21	RoboHELP SharePoint HTML
Documentation Manager	Manage the overall documentation process	RoboHELP SharePoint HTML
Help Desk	Same roles as today, but include IS21 support	Help desk software Interactive communication tools such as SMS and NetMeeting Business knowledge SharePoint IS21 knowledge SQL T/SQL
Project Manager	Manage the transition of IS21 Manage implementation of IS21 On-going management of support and enhancements of IS21	Project Management Management level understand of all technologies and tools used
Quality Assurance		
Version control	Establish policies for version control Verify version readiness Manage transition from development to system testing to production	Project Management QA concepts
Release testing	System test new features of IS21 System test fixes for problems Regression testing to assure changes have not had adverse effect on other parts of application	Strong testing techniques Regression testing software

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Role	Description	Tools/Technology
Training end users	Train users on use of IS21 during implementation and on-going Train users on ad hoc reporting Train users on appropriate use of IS21 SharePoint portal Train users on use of equipment installed for IS21	IS21 IS21 SharePoint portal Policies & procedures Crystal Reports for Ad Hoc
Branch equipment support	Install hardware in branches Support hardware in branches	Windows 2000 Professional IE 5.5 or higher SMS SharePoint client
Security Officer	Administer the Active Directory based security model for the IS21 application.	Active Directory Services Windows 2000 Admin
SharePoint coordinator	Overall administration of the IS21 SharePoint portal	SharePoint Portal Server administration tools

3.2.2 DoIT Role Requirements

Table 3.2: DoIT Roles

Role	Description	Tools/Technology
Server acquisition	Acquire needed servers for development, testing, and production	
Server support	Technical support of the IS21 server farm, including capacity management	Windows 2000 Advanced Server Windows 2000 Server Active Directory Services IIS5.0+ Front Page Extensions SharePoint Portal Server
Server accessibility	Establish policies and procedures for gaining access to IS21; policies needed for each processing environment.	Active Directory Services SharePoint document management
Database Administrator	The DBA will fill roles as documented in Section 7.5.	SQL Server 2000 Windows 2000

4 Development Environment

4.1 Purpose

A well-planned and executed development environment is critical to achieving success in all measures of a software project. This section covers the main tools and mechanisms that will be employed during the IS21 application development cycles and used to support the application after development.

4.2 Development Tools & Technologies

4.2.1 Programming Languages

Database

T-SQL: SQL Server's extended SQL language provides programming functionality beyond ANSI SQL. One powerful new feature of SQL Server 2000 is the ability to produce functions. T-SQL provides integrated debugging features with Visual Studio.

Business & Data Access Components

Visual Basic.NET: Used to develop the Web Services and Presentation tier as part of the Visual Studio.NET development platform.

ADO.NET ActiveX Data Objects provide a pre-built COM object model for accessing and manipulating databases.

User Interface

ASP.NET: IIS provides ASP.NET (Active Server Pages .NET) services to allow the generation of the User Interface HTML documents and the linking of those documents to the Web Services business logic tier.

JavaScript: A proper subset of Java, JavaScript will be used for client scripts when the targeted browser is unknown. It can also be used for client scripts in applications targeting only Internet Explorer. Access Indiana will use JavaScript for public client-side scripting, when appropriate.

HTML 3.2: The full functionality of the W3C standard HTML level 3.2 will be leveraged as appropriate, when the target browser environment can be predicted.

DHTML: Used for client side validation and any dynamic client side processing needed on the user interface, when the target browser environment can be predicted.

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XML & XSLT: These standard meta-languages will be used to provide user interface functionality and data exchange between applications and components. Versions of IE 5.5 and greater include a built in XML parser (MSXML).

4.2.2 Programming Tools

The following tools will be used in development and maintenance of the IS21 project:

Microsoft Visual Basic: Provides an integrated IDE environment for developing and debugging Visual Basic components. Visual Studio.NET will be used for development and maintenance of the data access and business components, and for the generation of the presentation tier of the application.

Microsoft Visual SourceSafe: The server components will be used for version control of all code bases, including database-stored procedures (T-SQL), VB COM components, and ASP.NET components. This product integrates tightly with all the Visual Studio IDEs, making development use much more efficient. It may also be used for additional code base and documentation as needed.

Crystal Reports 8.5 Enterprise Edition: Provides report development IDE, as well as Web Reporting Server components.

4.2.3 Source Control

Overview

All project source code will be managed in a secured, centralized environment. Full access to versions of the source code and related project documents will also be maintained. Microsoft Visual SourceSafe (VSS) will be used for management of all such documents and developed software.

Visual SourceSafe

Microsoft's Visual SourceSafe (VSS) helps manage documents and projects, regardless of the file type (text files, graphics files, binary files, sound files, and video files) by saving them to a database. When files need to be shared between two or more projects, they can be available to multiple users quickly and efficiently. When a file is added to VSS, it is backed up on the database, made available to other people, and changes that have been made to the file are saved so an older version may be recovered at any time. Members of a team can see the latest version of any file, make changes, and save a new version in the database.

Visual SourceSafe (VSS) can maintain multiple versions of a file, including a record of the changes to the file from version to version.

Version control addresses the following areas:

Team Coordination: Ensuring, by default, that only one person at a time is modifying a file. This prevents changes in files from accidentally being replaced by another user's

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changes. An administrator can change this default to allow multiple simultaneous checkouts of a single file, while still preventing overwrites of other changes.

Version Tracking: Archiving and tracking old versions of source code and other files, which can be retrieved for bug tracking and other purposes.

Cross-Platform Development: Tracking portability issues involved in maintaining one code base across multiple development platforms.

Reusable or Object-Oriented Code: Tracking which programs use which modules so that code can be reused.

Visual SourceSafe Implementation

Stored Procedures: SQL Server stored procedures can be maintained in version control by installing SourceSafe on the database server.

Business Components: Middle-tier business and data access components should be held in a SourceSafe project. This SourceSafe database can be installed on a development file server, and should be backed up nightly. All Visual Studio products, including Visual Basic, have integrated SourceSafe functionality for check-in, checkout, and easy access to other useful SourceSafe features.

User Interface Components: The user interface code base can be held in version control by installing SourceSafe on the development/test IIS5.0 server. This will allow developers to use the Visual Studio IDE for easy check-in and checkout of components (e.g. ASP.NET, JScript, VBScript)

4.2.4 Data Dictionary

The data dictionary for the IS21 project has been documented in the Phase I project using the Oracle Designer product. The Entity Relationship Diagrammer represents the data-centric system requirements (a logical database model) and provides access to the Database Design Transformer for creating the physical database schema (physical database model). Standard information engineering notation is used to represent things of importance (entities), their properties (attributes) and how entities relate to each other (relationships).

The Oracle Designer product uses a repository database, housed on an Oracle database server. The use of the repository database allows multiple data analysts to interact with the data model simultaneously.

The logical data model will be continuously updated during the detailed design sessions as part each of the development projects. Physical data models will be generated as needed to support the development efforts.

4.3 Development Framework

4.3.1 Daily Builds

During significant development projects, software components developed by individual team members will be submitted daily for a rebuild of the test environment. This process ensures that each developer's code stays synchronized with the project and is system-tested. Without a daily build process, progress will inevitably slow or stop, and system-testing time needs will increase dramatically. A developer will only check in code that has been thoroughly unit-tested. There may be builds with no new code checked into the system, but it is still beneficial to keep the build process moving in a project.

A tool for automating builds, such as "Make" or "SQL Robot", will be selected and utilized during the initial development project. The task of managing and performing daily builds will be assigned to specific development team members for each project.

The testing and quality assurance roles, as defined for each development project, will be responsible for system-regression testing.

4.3.2 Code Reviews

Regularly scheduled code walkthroughs will be performed during the development phases to ensure that developers are all using the same coding standards and techniques. Coding standards will be finalized as part of the initial development project and will be published for access by all team members.

Peers on the development team will do the code reviews. The code reviews will assist in detecting code defects well before final system testing occurs. The main purpose of a code walkthrough is to increase and control software quality. In addition, it has the benefit of speeding up overall development time by addressing requirements issues early in the design and development process.

4.3.3 Testing & Debugging

Developers shall be responsible for unit-testing all developed functions and components before checking them into version control. To do this, it is often necessary for the developer to construct his/her own "test harness" to test the new code base. This means that each developer's PC must contain all of the necessary services to perform local testing.

Debugging will be greatly facilitated by the use of the Visual Basic and Visual Studio IDE, which provide full debugging capabilities down to the stored procedure level.

4.3.4 Software Design Practices

In order to reach the goal of creating error free software in a team development environment, identifying software flaws early in the development cycle is key. Flaws introduced in the design stages of a development project can contaminate the entire project. To mitigate design-stage flaws, it is recommended that the detailed design

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document (identified as the Functional Design Specification in the Unisys Statement of Work for Phase II) include anticipated test results and identify test cases to completely test the developed software. It is arguably more important to set good design and coding practices as higher priorities than maintaining a schedule.

During the initial development project, design and coding practices will be developed and well documented.

Additionally, there are a number of tradeoffs to consider when writing software for an application. Some of these tradeoffs include:

- How fast should it be?
- How much memory does it use?
- How understandable is the code?
- How likely is the code to contain bugs?
- How much does the code look for errors?
- How hard is it to test the code?
- How robust is the code?
- How soon will the code be finished?

In a team development environment, it is critical to discuss these questions as a team. This will be accomplished through periodic code reviews. It is important that each developer has a notion of how to weigh the many tradeoffs for a particular project.

4.3.5 Software Development Practices

During development of a system, priorities will change. However, it is always important to develop software for the future. As the development cycles progress in a project, priorities will shift. It is important that developers pay close attention to maintainability, robustness, and readability in the early stages of a project. As the project progresses to the system-testing stages, developers will shift more focus to optimization of already-working code. It is important to remember "if it works, don't fix it".

Software will be written for humans. The ability to support and debug software is more important than writing software that minimizes resources or lines of code.

Software will be written proactively to prevent errors. For example, if an input should not be a negative value, raise an error (or stop execution). This will prevent flaws from mutating into other dependent procedures, components, or services.

Software will be as self-documenting as possible. Use of consistent naming conventions is key. The IS21 project will use the development conventions used by the Microsoft Consulting Services Group (<http://support.microsoft.com/support/kb/articles/Q110/2/64.asp>). This is included as [Appendix C](#).

Additionally, self-documentation is achieved with a liberal use of comments. In-line comments will be used in the code wherever specific clarification is needed. Indentations will be used to make logical blocks of an algorithm stand out. For example, all code within a "do-while" control loop will be indented.

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During the initial development project, well-defined coding practices will be developed and documented.

4.3.6 Software Documentation

The use of development standards will provide a level of “self-documentation” within each code module. Additionally, the design process will create software module/screen/report specifications that will be published on a technical “intranet” for immediate accessibility to all members of each development project.

User-oriented documentation will include screen/report documentation, field documentation, and system messages.

Microsoft’s SharePoint Portal Server will be used for version control and document delivery for the user- and technician-oriented documentation. RoboHELP will be used to format the Procedures, Screen/Report, Field, and Messages help documentation. See Section 9 of this document for more information on this subject.

One of the tasks of Phase II is to develop the standard formats for the user documentation pieces. BMV Subject Matter Experts (SMEs) will provide knowledge content when appropriate. Documentation specialists will use RoboHELP to prepare that content in the standard delivery format.

4.4 Testing and Deployment Process

A well-planned testing and release regimen will be a critical factor in the success of the IS21 project. In light of the nature of the developer resources, it will also be important to agree upon a common build and release plan. We recommend that the IS21 project employ a simple, four-stage approach to all development and testing (initial development AND on-going maintenance/support). See Figure 2 and the descriptions below for details.

4.4.1 Stage 1

Development and unit testing of VB/COM components and ASP.NET pages will occur on each individual developer’s PC. Server extensions used on the web servers and Visual SourceSafe will provide full source and version control capabilities on the web site. As the ASP.NET pages are coded and unit-tested on the developers’ local machines, they can be checked into the test web site. VB/COM components will also be developed and unit-tested on the local machines, and checked into the SourceSafe database for a test build. VB/COM layer builds will occur daily, or as needed, on the test web server. For simplicity, the developers’ unit-testing environment will point to the test website’s test DB instance for database services. This will require some careful coordination with developers whenever database changes are made.

4.4.2 Stage 2

All developed and unit-tested code will be checked into the stage 2 test server housed at Quest. This stage will allow system-regression testing activities *before* moving the components to the staging environment. Stage 2 also provides an additional layer of

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system testing before sending code to the staging site, where users can view and system-test the site before production releases occur. The test database instance is in stage 2, and all database and T-SQL changes will be made and tested there before moving on to the staging environment. After the development cycles have picked up, a daily build process will occur to get the middle tier components established on the Stage 2 test server.

The development team will be responsible for conducting these testing tasks.

4.4.3 Stage 3

On a periodic (or as needed) basis, a production pre-release of the entire web site will be moved to the staging site. The staging site will be used for user review and user-performed system testing and will be made available to outside stakeholders as well. Final system-regression testing will also occur on the staging site. System testing issues will be logged and issued to change management as needed.

End users will perform Stage 3 testing. IS staff will manage and coordinate the Stage 3 testing process.

4.4.4 Stage 4

When the staging site has been completely system tested, all code can be packaged and moved to Stage 4 production site. The BMV will assign a manager who will coordinate all build activity between the four stages. Each development and testing cycle will involve three production release builds, as shown in Figure 1.

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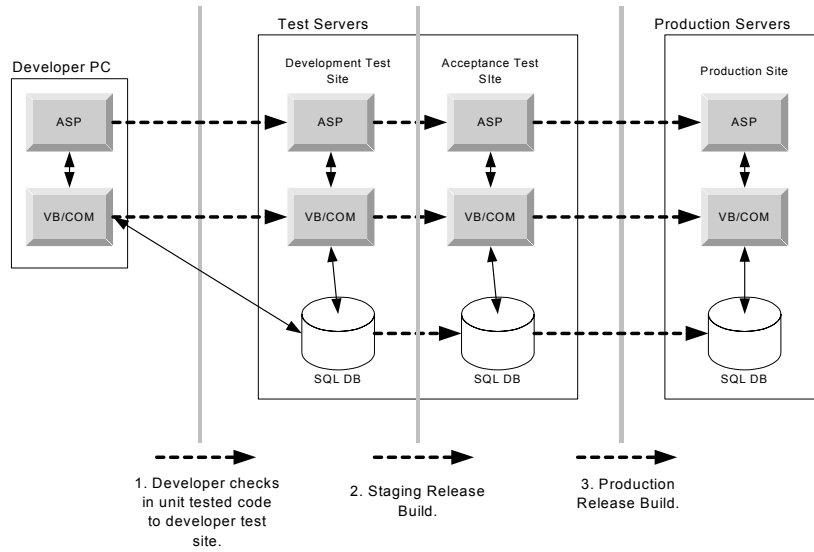


Figure 4.1: System Testing and Deployment Diagram (bold dashed lines indicate build release activity)

5 Branch Equipment Environment

5.1 Background

Workstation technologies must support:

1. A transaction-processing system delivered using a standard PC browser interface
2. Complete cashiering activities at any CSR workstation
3. Barcode reading for fast entry and retrieval of data
4. Capture of the customer's digitized handwritten signature
5. Retrieval of digital documents images for viewing and printing

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In addition to the workstation requirements, branches may require:

1. Enhanced branch printing to support increased printing activities
2. The ability to create digital images of documents
3. Expediter Workstations
4. Self-Serve Expediter Stations

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5.2 Technical Workstation Requirements

5.2.1 Operating System

Branch workstations will utilize Windows 2000 Professional.

Windows 2000 Professional provides many accessibility features for persons with disabilities. Microsoft has been involved in accessibility issues since 1988. Windows 2000 continues to improve on the accessibility, and [Appendix B](#) provides more detail on the accessibility features in Windows 2000. Many products are available on the market to implement these features. This document does not detail any hardware requirements for this purpose, but some examples of available products are listed below. These are not presented as recommendations; they are presented here to illustrate accessibility features within Windows 2000 and to identify products to support these features.

Keyboard Enhancement Tools (such as Access Pack for Microsoft Windows). Access Pack provides a variety of features for people with limited dexterity or who are deaf or hard of hearing. These features include:

- Allow single-finger typing of SHIFT, CTRL, and ALT key combinations
- Ignore accidental keystrokes
- Adjust the rate at which a character is repeated when you hold down a key, or turn off character repeating entirely
- Prevent extra characters if a key is unintentionally pressed more than once
- Control the mouse cursor by using the keyboard.
- Control the computer keyboard and mouse by using an alternate input device.

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On-Screen Keyboard Utilities (such as HandiKEY on-screen keyboard). Includes word prediction, sticky keys, and text-to-speech output. HandiKEY can be used in direct select mode with a mouse, joystick, or trackball, as well as in manual or automatic scanning mode.

Screen Enlarger Utilities (such as those made by Number Nine). Number Nine makes video adapters with most of the standard enlarger features, including the ability to track mouse and insertion bar. It also relocates dialog boxes to the zoomed area, and allows users to adjust the size and color of the mouse cursor.

Voice Input Utilities (such as FreeSpeech 2000). FreeSpeech 2000 is the newest generation of Philips natural speech recognition software for Windows®-based PCs. It allows dictation into any Windows® application. FreeSpeech 2000 natural command and control allows a user to navigate within a Windows® environment, format and edit documents, and surf the web using nothing more than his/her voice.

5.2.2 Browser Software

Each workstation will be configured with the version of Internet Explorer that is the most current version when development of the IS21 application begins. At the time of this writing, the most current version is 5.5.

5.2.3 Implementation Support Software

Each workstation will have the SMS client, as specified by DoIT, installed to support remote software and driver updates, inventory control, and system-usage monitoring.

5.2.4 Anti-Virus Software

Each workstation will have the McAfee Virus Scan software. Computer viruses are malicious programs designed to destroy information. The McAfee software runs at all times, scanning incoming messages and files for known computer viruses. As more viruses are detected virtually every day, policies and procedures will be required to assure that updates are applied to the Virus Scan software on a regular basis.

5.2.5 Cashiering

Payment processing will require readers for credit and debit card processing equipment for each workstation that performs cashiering functions. For debit card processing, the device will require a numeric keypad for PIN entry. If a CSR station will handle cash, a cash drawer that interacts with the application when opening is also needed. CSR stations that do not handle cash, but do handle checks, will require a "lock box" for the checks. A printer for credit card and debit card receipts will also be required for all stations with cashiering functions. This same printer will have the ability to endorse checks. Customer signatures for debit and credit card processing will be captured electronically, using the same device as used for other transaction e-signatures.

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5.2.6 Barcode Readers

Each branch workstation will need a barcode reader to read magnetic strips on driver's licenses, license plates, titles, and other transaction-related items. The bar code reader will need to support the two-dimensional PDF 417 bar codes used on the driver licenses. The same device must also support the one-dimensional bar codes that would appear on other items. The barcode reader must interact with the application to automatically provide what is read to the application.

5.2.7 Electronic Handwritten Signature Device

Electronic signature devices will be required at each workstation to capture and store customer signatures electronically. While electronic capture of signatures is designed into the IS21 application, support for "pen and ink" signatures will continue for those individuals who are opposed to providing an electronic signature.

5.2.8 Document Images

In the re-engineered system, documents will be stored as digital images rather than on microfilm. This makes documents available at any workstation. A more complete discussion of digital imaging can be found in Section 12 of this document.

5.3 Branch Equipment Deployment Notes

5.3.1 Branch Equipment Quantities

The following table provides quantities and phasing for new branch equipment required for IS21:

Table 5.1: Branch Equipment

Branch Device Matrix		Total	
		Units	Phase
Number of Branches		177	
Number of CSRs		1,043	
1. CSR Workstation			
Laser printer		584	2
Data jack		584	2
Barcode reader		1,043	2
Receipt & validation printer		1,043	2
PIN pad/magnetic stripe reader		1,043	2
Electronic signature device		1,043	2
Lock box		1,043	2
USB hub, cables		1,043	2
2. Cashier Workstation			

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Branch Device Matrix	Total Units	Phase
Computer workstation	54	2
Data jack (workstation)	54	2
Barcode reader	54	2
Receipt & validation printer	54	2
PIN pad/magnetic stripe reader	54	2
Electronic signature device	54	2
Cash drawer	54	2
Lock box	54	2
Laser printer	54	2
Data jack (printer)	54	2
USB hub, cables	54	

3. Expediter Workstation

Computer workstation	29	2
Data jack (workstation)	29	2
Barcode reader	29	2
Laser printer	29	2
Data jack (printer)	29	2

4. Self-Serve Expediter Stations

Computer workstation	25	TBD
Data jack (workstation)	25	TBD
Touch screen	25	TBD
Barcode reader	25	TBD
Laser printer	25	TBD
Data jack (printer)	25	TBD

The Branch Device Matrix worksheet summarizes the new equipment that will be required in the branch office to meet the requirements of the IS21 deployment. The matrix lists the different types of workstations that will be deployed and the additional accessories and components associated with each type of workstation.

The amount in each row of the Total column is the product of the Unit Cost and the Total Units required across all branches. The Unit Cost column is the estimated cost of the described item. The Total Units column is the sum of the number of devices required to equip each branch.

Cost estimation requirements are based upon the size of the branch. The **Number of CSR stations in branch** row describes the size of a branch; this number ranges from 1 to 37. (In the detail worksheet, a column is provided for each size branch; the **Number of Branches** row shows the number of branches of each size; the **Number of CSRs** row shows the total number of CSR stations across all branches of that size.)

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While representative of devices required for fulfilling the business requirements of the system, the costs enumerated here are for estimation purposes only; the device manufacturer and model will be determined during the detail design phase after the specific device requirements are determined and integration testing of hardware and software components has been conducted to ensure successful deployment.

5.3.2 CSR Workstation

- **Number of CSR laser printers in branch:** It is assumed that document laser printers will be shared, with one printer per every two CSR stations. The number of CSR laser printers in each branch is rounded up so that no more than two CSR stations will share a single printer. Some branches currently exceed the 2:1 printer-to-CSR ratio; this number of “extra” printers, currently 21, is reflected in the *Extras* column and has been included in the total in order to ensure that we provide no fewer document printers than are currently available in each branch.
- **Laser printer:** The estimated cost per document laser printer is based on the price of a HP LaserJet 2200dtn. This printer provides three input trays (250 sheet tray, 500 sheet tray, 100 sheet multipurpose / bypass tray), duplexing capability, and an integrated 10/100Base-TX Jetdirect internal print server for direct attachment to the network. Duty cycle is 40,000 pages per month.
- **Data jack:** Each document laser printer will be a network-attached device and will require its own network connection.
- **Number of CSR workstations in branch:** This number is carried down from the *Number of CSRs* row.
- **Barcode reader:** Device will scan both 1d and 2d barcodes on various documents (drivers license, title, registration, etc.) to facilitate information retrieval and speed data entry.
- **Receipt & validation printer:** Print original credit card receipt and validate checks; journal capability.
- **PIN pad/magnetic stripe reader:** Supports credit card and debit card transactions.
- **Electronic signature device:** Assume single device can be used for all purposes (charge card receipt, electronic document signature, *et al*)
- **Lock box:** Secure deposit of validated checks and original signed credit card receipts.
- **USB hub, cables:** Connection point to attach peripheral devices to workstation.

5.3.3 Cashier Workstation

- **Number of cashier workstations in branch:** The number of cashier workstations required in each branch is estimated based on the number of CSR workstations in the branch. This estimate maintains a minimum 4:1 ratio of CSR workstations to Cashier workstations (an allowance has been made for the back-room operations at the Speedway branch).

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- **Computer workstation:** Current cashier stations are independent, stand-alone cash register systems. The integrated cashier workstations function will require the acquisition of a computer workstation equivalent to the current CSR workstation. Current CSR workstation pricing is used for this cost estimate.
- **Data jack (workstation):** Each cashier workstation will be a network-attached device and will require its own network connection.
- **Barcode reader:** Device will scan both 1d and 2d barcodes on various documents (drivers license, title, registration, etc.) to facilitate information retrieval and speed data entry.
- **Receipt & validation printer:** Print original credit card receipt and validate checks.
- **PIN pad/magnetic stripe reader:** Supports credit card and debit card transactions.
- **Electronic signature device:** Assume single device can be used for all purposes (charge card receipt, electronic document signature, *et al*)
- **Cash drawer:** Secure, organized deposit of cash and coin.
- **Lock box:** Secure deposit of validated checks and original signed credit card receipts.
- **Laser printer:** The estimated cost per cashier laser printer is based on the price of a HP LaserJet 2200dn. This printer provides two input trays (250 sheet tray, 100 sheet multipurpose / bypass tray), duplexing capability, and an integrated 10/100Base-TX Jetdirect internal print server for direct attachment to the network. Duty cycle is 40,000 pages per month.
- **Data jack (printer):** Each cashier laser printer will be a network-attached device and will require its own network connection.
- **USB hub, cables:** Connection point to attach peripheral devices to workstation.

5.3.4 Expediter Workstation

- **Number of expediter workstations in branch:** The number of Expediter workstations required in each branch is estimated based on the number of CSR workstations in the branch. This estimate maintains a minimum 8:1 ratio of CSR workstations to Expediter workstations for branches with more than four CSR workstations (an allowance has been made for the back-room operations at the Speedway branch).
- **Computer workstation:** The Expediter workstations will require the acquisition of a computer workstation equivalent to the current CSR workstation. Current CSR workstation pricing is used for this cost estimate.
- **Data jack (workstation):** Each cashier workstation will be a network-attached device and will require its own network connection.
- **Barcode reader:** Device will scan both 1d and 2d barcodes on various documents (drivers license, title, registration, *et al*) to facilitate information retrieval and speed data entry.

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- **Laser printer:** The estimated cost per cashier laser printer is based on the price of a HP LaserJet 2200dn. This printer provides two input trays (250 sheet tray, 100 sheet multipurpose / bypass tray), duplexing capability, and an integrated 10/100Base-TX Jetdirect internal print server for direct attachment to the network. Duty cycle is 40,000 pages per month.
- **Data jack (printer):** Each cashier laser printer will be a network-attached device and will require its own network connection.

5.3.5 Self-Serve Expediter Station

- **Number of self-serve expediter workstations in branch:** The number of Self-Serve Expediter workstations required in each branch is estimated based on the number of CSR workstations in the branch. This estimate maintains a minimum 10:1 ratio of CSR workstations to Self-Serve Expediter workstations for branches with more than four CSR workstations (an allowance has been made for the back-room operations at the Speedway branch).
- **Computer workstation:** The Self-Serve Expediter Stations will require the acquisition of a computer workstation equivalent to the current CSR workstation. Current CSR workstation pricing is used for this cost estimate.
- **Data jack (workstation):** Each cashier workstation will be a network-attached device and will require its own network connection.
- **Touch screen:** The standard workstation display will be replaced with a touch-sensitive screen on Self-Serve Expediter stations.
- **Barcode reader:** Device will scan both 1d and 2d barcodes on various documents (drivers license, title, registration, *et al*) to facilitate information retrieval and speed data entry.
- **Laser printer:** The estimated cost per cashier laser printer is based on the price of a HP LaserJet 2200dn. This printer provides two input trays (250 sheet tray, 100 sheet multipurpose / bypass tray), duplexing capability, and an integrated 10/100Base-TX Jetdirect internal print server for direct attachment to the network. Duty cycle is 40,000 pages per month.
- **Data jack (printer):** Each cashier laser printer will be a network-attached device and will require its own network connection.

5.4 Other Technical Requirements

5.4.1 Printers

The new system calls for more printing in the branches than is typically done today. The printing requirements of IS21 include, but are not limited to, printing titles, barcodes, letters, registration quotes, permits, estimates, voter registration forms, comeback passes, and processing checklists. Barcodes and special forms, such as titles, require high quality printing. Laser printers are necessary to meet the printing requirements of the IS21 application. The laser printers will replace the current form printers used in the branches. Multi-copy forms will be handled on the laser printers by printing multiple "original" documents, with the paper and/or text of the document differentiating originals

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from copies. The selected laser printers will have multiple paper drawers to accommodate different paper types, and will support two-sided printing.

Currently, ITI thermal printers are used to print registrations. Digital Drivers License (DDL) printers are used to print driver's licenses. Both of these requirements will continue unchanged in the new system. Because there is no change in design, it is not necessary to replace either of these printers for the new IS21 application. However, as the ITI printer contract does expire during the development of the IS21 application, the BMV will be looking at possible replacements for the ITI printers. The IS21 application will be able to interface with any standard technology selected as replacements for these printers.

5.4.2 Document Imaging

Reinstatement centers, which now do their own microfilming, will require document-imaging equipment. Other imaging, at least initially, will continue to be done by the central office. The design of the new system, however, allows for any and all branches to do their own imaging. A more detailed discussion of document imaging is available in Section 12 of this document.

5.4.3 Expediter Workstations

Larger branches may require Expediter workstations. An Expediter workstation will consist of a standard CSR workstation (PC and monitor), a barcode reader, and a printer. The printers for these workstations will not need multiple paper drawers or duplexing features.

5.4.4 Self-Serve Expediter Stations

Larger branches may also require Self-Serve Expediter Stations. A Self-Serve Expediter Station will be configured like the regular Expediter workstation, except that the monitor for the station will be a touch screen monitor. The touch screen monitor provides a "friendlier" and simpler user interface for the customer.

6 Back Office Technologies

Several Microsoft BackOffice servers and technologies will be utilized in the delivery of the IS21 application.

STARS Production Servers

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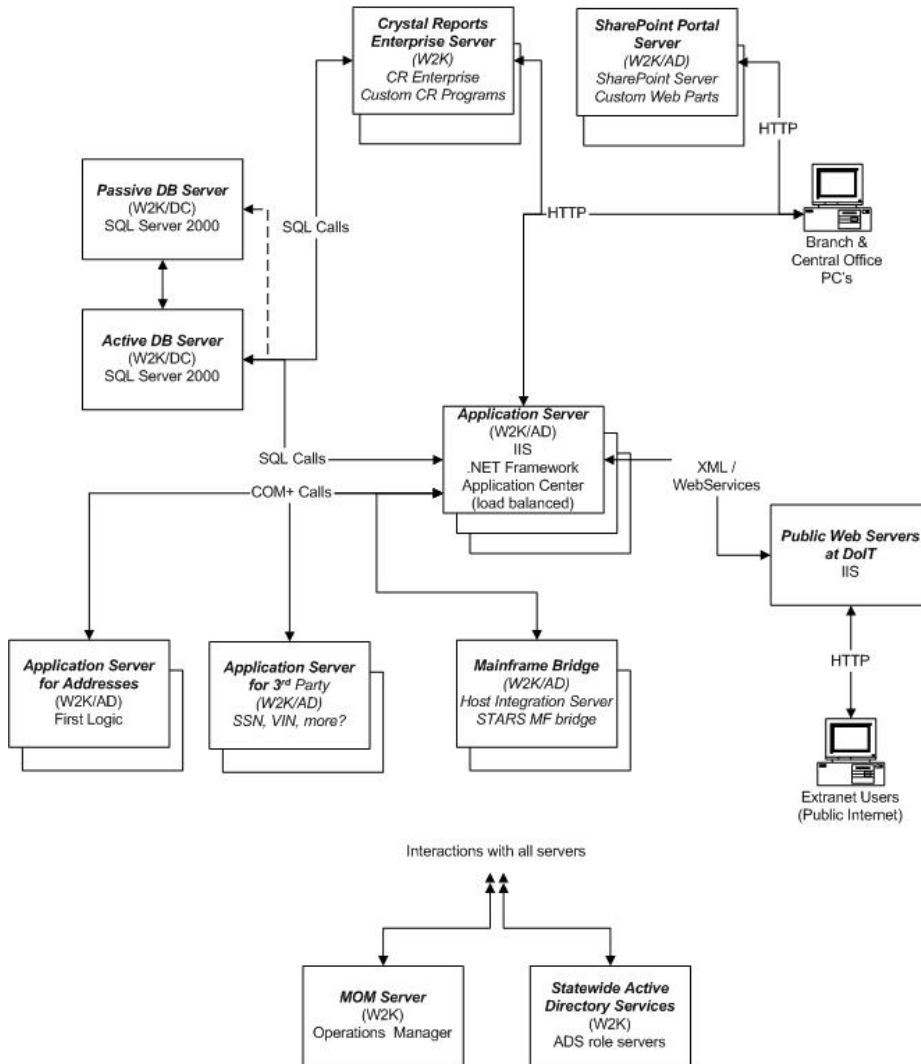


Figure 6.1: IS21 BackOffice Server Environment

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6.1 Windows 2000 Server

Workstations accessing the IS21 application will run the Windows 2000 Professional operating system (see Section 5.2.1). All tiers of the IS21 application will be hosted on servers that will use Windows 2000 Server as the operating system. Windows 2000 Server family consists of three products:

- **Windows 2000 Server** is the entry-level version for file, print, intranet, and infrastructure servers; it runs on platforms with one to four processors and up to four gigabytes of memory
- **Windows 2000 Advanced Server** incorporates features for enhanced reliability, availability, and scalability; it is well suited for running e-commerce and line-of-business applications. Advanced Server supports platforms with one to eight processors and up to eight gigabytes of memory, two-node clustering, and 32-node network load balancing
- **Windows 2000 Datacenter Server** is designed as an enterprise-class platform to support applications and services that demand the highest levels of availability and scale. Datacenter Server supports platforms with one to 32 processors and up to 64 gigabytes of memory, four-node clustering, and 32-node network load balancing

All servers deployed in support of the IS21 application will utilize Windows 2000 Advanced Server or Windows 2000 Datacenter Server (depending on the hardware platform selected). Windows 2000 Server, Advanced Server, and Datacenter Server provide a number of integrated services and technologies that will be leveraged by the IS21 application:

6.1.1 Active Directory Service

Active Directory is an integral part of Windows 2000 Server that enables essential network operating system services:

- Active Directory is the focal point for managing users and other elements (applications, servers, devices)
- Active Directory is the trusted repository of security data for authentication and authorization
- Active Directory provides an open platform for application development and integration with other systems

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Active Directory will be the repository for all user information for the IS21 project. Security within the application will be role-based; roles will be mapped to users through Active Directory constructs.

BMV and BMV user information in Active Directory can be leveraged in the deployment of other Windows 2000 applications and services (e.g. Microsoft Exchange 2000 deployment).

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6.1.2 Web Services (Internet Information Server)

The built-in Windows 2000 web server, Internet Information Service (IIS), will provide web services for the IS21 system. IIS supports the latest Internet standards and features improved reliability, scalability, and performance.

IIS provides the ASP.NET (Active Server Pages) server-scripting environment, supporting both Visual Basic and JavaScript.

IIS is integrated with Active Directory services for authentication and authorization.

IIS includes support for use of COM+ components, XML integration (through the XML parser), and Windows Script components within the ASP.NET.

6.1.3 Component Services

Component Services is the Windows 2000 integrated tool used to install and manage Component Object Model (COM)+ services. It supports the administrative tasks associated with managing COM+ services, which fall into four broad categories:

- Configuring the system for Component Services
- Making initial services settings
- Installing and configuring applications
- Monitoring and tuning component services

Component Services facilitates the process of preparing and testing new or updated COM+ application components in a staging environment, then exporting them and installing them on production servers.

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6.1.4 Microsoft Message Queue (MSMQ)

Microsoft Message Queue (MSMQ) technology ensures that applications running on distributed systems are able to endure temporary system or network outages. Applications communicate by sending messages to queues and reading messages from queues.

MSMQ provides guaranteed message delivery, routing, security, and priority-based messaging services. MSMQ is integrated with other Windows 2000 features, including IIS, clustering services, and the security environment. MSMQ is one of several components used to ensure the scalability and reliability of the IS21 application, and will be critical during the interaction with the mainframe applications.

6.2 Other Back Office Components

6.2.1 BizTalk Server

BizTalk Server consists of a suite of tools and services that facilitate building business processes and integrating applications. It includes graphical tools for building Extensible

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Markup Language (XML) schema, performing schema transformation, tracking, and analyzing data exchanged between applications or application components.

BizTalk Server will assist in the integration of the IS21 application with existing systems and applications, as well as facilitate the exchange of data with other systems in the future.

6.2.2 Application Center 2000

Application Center 2000 provides coordination and management services for all business logic modules on multiple servers. It is Microsoft's deployment and management tool for high-availability web applications built on the Windows 2000 operating system. Application Center will be used to address three areas of concern in the deployment of the IS21 application:

- **Application management** complexity is reduced by allowing administrators to construct logical groupings of components, content, and configuration information; many servers can be managed as one, streamlining application deployment and maintenance. Components can also be load-balanced.
- **Scaling** is simplified and enhanced by facilitating software scaling (sometimes referred to as 'horizontal scaling') through the use of Application Center 2000; changes in demand (increase or decrease) can be met by easily adding or removing servers
- **Availability** of this mission-critical application is enhanced as any individual server managed by Application Center may be brought down without affecting the availability of the application--hardware and software failures can be tolerated without disrupting service. Application Center also provides enhanced performance and health monitoring capabilities and automated event responses.

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Application Center 2000 can be leveraged to support "rolling upgrades" of individual server hardware or software components, further enhancing overall system availability and reliability, as system software patches can be quickly deployed.

6.2.3 SharePoint Portal Server

The SharePoint Portal Server (SPS) will be used to provide document management capabilities in support of the IS21 application and BMV operations. Managed documents will include IS21 help files and documentation, as well as BMV organizational policies and procedures (see Section 9.3.1).

Additionally, SPS is being considered as the primary entry point to the IS21 application, as well as the documentation system for BMV users of the application. This decision will be made during the detailed design module that is focused on the standard user interface for the IS21 application.

SPS runs on a Windows 2000 web server (running IIS) and provides flexible user interface to its powerful indexing, document management, information organization, and presentation capabilities. All of this is accomplished through the same browser interface used for the delivery of the IS21 application. SPS uses role-based security (e.g.

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coordinator, author, reader) to control access to and management of documents, leveraging the authentication and directory services of Active Directory.

6.2.4 Host Integration Server

Host Integration Server provides a means for obtaining secure access to existing host-based data. It provides application, data, and network integration between the IS21 application and existing host-based systems. Host Integration Server provides access to data and translation between new and existing systems utilizing Windows 2000 features including Microsoft Message Queue (MSMQ), Component Object Model (COM)+ and Microsoft Application Center services.

The IS21 application will interact with the existing mainframe using CICS transactions. This is detailed in Section 8 of this report.

6.2.5 SQL Server 2000

SQL Server 2000 will be the database engine supporting the IS21 application. It will provide data storage and retrieval capabilities to the other tiers of the application system.

SQL Server 2000 provide powerful indexing and data retrieval capabilities in a fully web-enabled database. Both provide core support for Extensible Markup Language (XML), HTTP, and other Internet technologies. SQL Server takes full advantage of Windows 2000 features and functionality, including support for Active Directory.

The database environment is discussed further in Section 7 of this report.

6.3 Management Services

DoIT will provide systems and operational management of servers and workstations deployed to support the IS21 project. It is expected that IS21 operations will be folded into existing DoIT systems management processes and procedures. These services are further described in Section 15 of this document.

6.3.1 Systems Management Services (SMS)

DoIT currently provides SMS services in the management and support of workstations throughout the organization. BMV will utilize SMS features in support of IS21 application.

The workstation-shadowing feature of SMS is provided through the NetMeeting product. NetMeeting will be configured and deployed to allow Help Desk personnel to observe exactly what a CSR is doing and more effectively walk the user through an unfamiliar procedure. Help Desk staff can utilize this shadowing feature to take control of a user workstation to resolve a problem on behalf of the user, or to walk the user through an unfamiliar process or procedure, allowing him/her to observe the process. This can be a much more effective support method—and far more efficient—than trying to talk the user through the process over the telephone.

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SMS provides extensive hardware and software inventory capabilities that enhance the collective management of individual systems. SMS will work in conjunction with and enhance the management features integrated into Windows 2000 Professional and Windows 2000 Server family products.

6.3.2 Microsoft Operations Manager (MOM)

Microsoft Operations Manager (MOM) is a comprehensive collection of event and performance management tools for the Windows 2000 server family and .NET Enterprise Servers. MOM provides a central collection point for event management and performance data, allowing administrators to more easily monitor and manage this information.

Monitoring and alerting functions allow administrators to filter events and proactively deal with developing problems before they have a chance to adversely affect performance or availability.

6.4 File and Print Services

Standard Windows 2000 file and print services will be utilized extensively for the storage of documents and procedures, programs, and other elements of the IS21 application.

All printers utilized by the IS21 system will be network-attached devices. Windows 2000 print queue management facilities will be utilized to manage print jobs to these printers from the central application servers. Documents may also be printed from the IS21 workstations directly to these printers (e.g. from within the SharePoint Portal Service).

Printers will be catalogued and managed through Windows 2000 Active Directory services.

6.5 Physical Server Environment

During the development of the IS21 application, load testing will be performed for final server capacity recommendations. The follow table represents an initial server capacity recommendation, based on two hardware configurations:

6.5.1 Database Servers

The database services will be configured as an Active/Passive redundant server – a second database server will be in operation, but used only in case of failure of the primary server. During the initial application development project, the physical database will be designed and application components will be benchmarked, providing an accurate projection of database server resource requirements.

At this time, a very preliminary configuration includes:

- Four (4) Processor(s) Intel Pentium III Xeon 1000 MHz standard (up to 8 supported)

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- 4 GB Memory (expandable to 16 GB)
- Fast Ethernet NIC 64 PCI Dual Port 10/100 in a slot
- Storage Controller Smart Disk Array Controller
- 50GB of disk (145.6 GB maximum) spread over numerous physical disks to reduce disk I/O contention
- 7U Rack Mounted

This particular configuration provides over 30,000 TPC-C transactions per minute, which represents a transaction volume many times greater than expected for the IS21 application.

6.5.2 Role Servers

The role servers provide the configuration to support all other servers in the IS21 network. The servers are configured to use minimal space (1 U-rack), have a minimal mirrored disk to house the application's components (data is all store in the RDBMS servers), and are scaled out instead of up (each has only two-processor capability).

At this time, a sample configuration includes:

- Processor Intel Pentium III processor 1.0 GHz (up to 2 supported)
- Memory varies from 1GB to 4 GB (Maximum)
- Fast Ethernet NIC (embedded) PCI 10/100 WOL
- Storage Controller Integrated Smart Array Controller
- Hard Drives Two (2) 36GB disks (mirrored)
- Form Factor Rack (1U)

Again, during each development IS21 phase, application benchmarks will be performed to determine specific server quantifies.

7 Relational Database Environment

7.1 Database Requirements

The relational database environment supporting the IS21 system will provide a scalable and highly available platform for the future storage and processing of the BMV's data. The database environment will contain a transactional system, as well as one or more data warehouse systems. The transactional system will support the on-line record update, creation, query, and business logic functions required to support the application services layer. The data warehouse systems will provide an independent, read-only environment to support reporting and ad hoc query functions.

The BMV requires a relational database environment that will provide high performance, is scalable, and can provide a very reliable solution. Either Microsoft's SQL Server 2000 will be selected as the relational database for the IS21 application and will be used over the Windows 2000 Server operating system.

7.2 Transactional Database

The transactional database environment will be housed on clustered, multiple Windows 2000 Server systems. The clustering environment of Windows 2000 Server coupled with SQL Server 2000 will provide automatic and complete fail-over. The recommended configuration is an active-passive installation, utilizing a second server that is used only if the primary server fails.

7.3 Data Warehouse Databases

The data warehouse database environment will consist of separate servers housing databases that house read-only data, provided to allow report generation and ad hoc querying with no impact on the performance of the transactional database system. The data housed in the data warehouse will be a subset or summary of the transactional data, and will be refreshed periodically (daily, weekly, monthly).

The use of a data warehouse is possible after the IS21 application has populated the transactional database with all data needed to build the data warehouse. For instance, after all branches are using the new application, data that will allow performance metrics about the branches can be loaded into a data warehouse. However, registration and driver information will be gradually added to the relational database, making a data warehouse of that information of minimal value until the transactional database is fully populated.

Data warehouse technology can be applied as the need is defined and multiple data warehouse can exist on single server platforms.

Specifically, data warehouses have been identified to support:

1. Complex law enforcement inquiries
2. BMV performance metrics
3. BMV statistical information

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4. Legislative impact analysis

7.4 Data Migration/Data Conversion

Data migration will be documented in detail in the Build Phase Strategy document. Generally, data will populate the relational database during the initial software deployment using mainframe-to-application real time filters (Section 8). Later development phases will complete the data migration through the use of data conversion programs.

7.5 Database Administration

SQL Server 2000 provides an automated approach to the DBA activities. It is critical, however, for an organization to understand the automated DBA tasks provided by SQL Server.

The DBA role will be primarily the responsibility of DoIT, and will be assigned to individuals who will perform all aspects of the role. DoIT will likely staff these roles with multiple individuals, and it is possible that the level of experience might cause some specialization to occur. Additionally, the BMV will need have staff that have some of the capabilities of the DBA to provide better support to its development and Help Desk staffs. Notations have been made when it is important for the BMV to redundantly staff a DBA role.

The DBA role will provide all DBA activities for the production, training, and staging servers (used for acceptance testing). The DBA will assist and/or perform DBA activities in support of the development servers (frequently, the developers will perform most of the DBA activities in support of the development server environment).

In general terms, the Database Administration function will provide services in the following areas:

- Installation and configuration of the database server environment
- Creation of databases
- Administration of database security
- Administration of data
- Backup and recovery tasks
- Resource management
- Network and connectivity support

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7.5.1 Installation and Configuration

The DBA will participate in the installation of the hardware and operating system for the database servers. The DBA will install the actual RDBMS software and will be responsible for adjusting operating system parameters as necessary to best support the RDBMS environment.

The DBA will configure the RDBMS software's initialization parameters.

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The DBA will configure the network connectivity parameters necessary to provide access to the RDBMS.

The DBA will define and configure startup and shutdown options.

The DBA will extensively participate in the configuration of the redundancy/clustering configuration of the operating system and the RDBMS.

The DBA will plan and implement all RDBMS software upgrades and all operating system upgrades associated with the database server environment.

7.5.2 Creation of Databases

The DBA will execute all scripts to create physical database structures.

The DBA will development and manage the process of moving changes to the staging server environment (for acceptance testing) and from the staging server to the production server(s).

The DBA will provide review of database physical design and make recommendations to the development team. This includes the potential use of triggers, functions, stored procedures, and data transfer packages, as well as any data denormalization activities.

This area of the DBA represents skills that the BMV should staff to assist their development teams.

7.5.3 Database Security

The DBA will create, alter, and drop database users. In an n-tier application, most user-based security will be managed in the middle tier. As a result, the bulk of this activity for the DBA will involve ad hoc user access.

The DBA will monitor and audit database access.

The DBA will participate in the development and implementation of a strategy for managing security (roles, privileges, and authentication).

7.5.4 Data Administration

The DBA will work with the development team to manage integrity constraints where appropriate.

The DBA will participate in the implementation the physical database based on the logical design.

This area of the DBA represents skills that the BMV should staff to assist their development teams.

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7.5.5 Backup and Recovery

The DBA will develop and manage the implementation backup and recovery strategies.

The DBA will monitor the backup operations to verify the success of those operations.

The DBA will perform periodic recovery tests of the backup procedures.

7.5.6 Resource Management

The DBA will create and manage indexes and will evaluate the use of clusters and hash clusters.

The DBA will allocate and manage physical storage structures (e.g., datafiles, redo logs, control files), as required by the RDBMS platform.

The DBA will allocate and manage logical storage structures (e.g., tablespaces, schemas, extents), as required by the RDBMS platform.

The DBA will control system resource usage by defining proper profiles (data views).

The DBA will perform capacity planning in relationship to the RDBMS environment.

The DBA will perform tuning and troubleshooting associated to the RDBMS environment.

The DBA will diagnose and resolve locking conflicts.

The DBA will collect and analyze relevant database performance information.

The DBA will identify and implement appropriate solutions for database performance problems.

7.5.7 Network and Connectivity Support

The DBA will define and troubleshoot all database connectivity commands used by users and the application.

7.6 Data Security

Security in an n-tier application is managed by roles in the middle tier. Middle tier connections are made by a usercode that is coded into the application. This approach greatly enhances scalability of the application and simplifies the management of database security.

Usercodes defined directly in the database are for users who connect to the database using ad hoc reporting tools or a traditional client server application that might be developed to support a specific business function.

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Additionally, if non-secured networks are used for ad-hoc or client server database connections, the BMV may want to consider using encryption between the database server and the client computer.

7.7 Data Dictionary

The logical database has been developed using Oracle's Designer tool and consists of entity definitions, entity relationships, and attributes. This logical database design will be converted using Designer's automated tools to a physical database design. Scripts to load the physical database schema will be generated from the physical database design.

The logical and physical models will be maintained for the full lifecycle of the IS21 application within Designer's repository. This repository will reside on a small server that can be accessed by each of the BMV's MVIS analysts, allowing them to leverage the data dictionary in their analysis processes.

Procedures will be developed as part of the initial application development project to manage use of the repository as the database evolves.

8 Mainframe Bridge

8.1 Continued Mainframe Usage

The migration of the BMV applications from the current mainframe environment (CICS COBOL programs using IMS and VSAM data structures) to the new IS21 architecture will be phased. During the initial development phase, the mainframe data will need to remain current to support software applications that are not included in that phase of development. Additionally, there will be no initial conversion of the main BMV data files in advance of the initial development phase. Data will be accessed from the mainframe real time, used by the new application, and then written both to the new relational database and to existing mainframe files.

The technical interface to the mainframe will be through utilization of CICS transactions. Host Integration Server will be used to expose the CICS transactions as standard COM+ objects, allowing for their easy integration into the new IS21 application.

Microsoft Message Queue will be used to isolate the new application from data synchronization issues that might occur if the mainframe CICS transactions were unavailable for some reason.

8.2 Application Process Flow

When a transaction is started in the new IS21 application during project phase in which mainframe data is still being maintained, the IS21 application process steps will generally be:

1. The relational database is checked for the existence of the data. If it exists, the application will proceed to step #4. If not, then the application will proceed to step #2.
2. The application will use a Host Integration Server COM+ component to retrieve the mainframe data using a CICS transaction.
3. The application performs the appropriate data conversions and filters to migrate the data to the format maintained in the relational database.
4. The application transaction is used to perform the required business functions.
5. The application updates the relational database.
6. The application will use a Host Integration Server COM+ component to write the mainframe data using a CICS transaction. MSMQ is additionally used to insure the transaction is committed to both the mainframe and relational database.

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8.3 Architecture

The following illustration provides an overview of how Host Integration Server will be leveraged to provide the IS21 application interface into the CICS mainframe transactions:

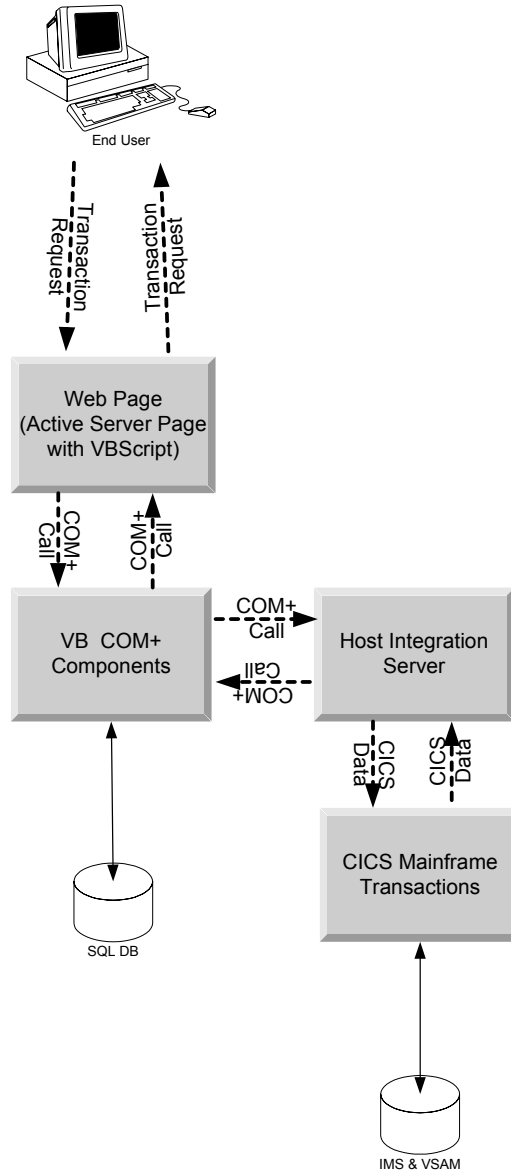


Figure 8.1: How the Host Integration Server Interfaces with the Mainframe

9 User Help and Documentation

9.1 Background

9.1.1 Current Environment

On-line help information for the current system was added after the development of the application system. As a result, the help is not well integrated into the process flow. Much of the policy and procedural information is only available in printed documents. Help Desks are currently available to the users, but they do not have processes or the technical environment that support utilizing experience as a knowledge base for resolving similar problems.

9.1.2 Proposed Environment

The general requirements for the proposed system are:

1. All documentation available on-line
2. Application Help seamlessly integrated into the on-line processes
3. On-line, on-demand access to application error message documentation
4. Automation of the Help Desk to track issues to completion, assuring an issue does not get dropped
5. Historical Help Desk experience used as Knowledge Management base for future issue resolution
6. Integrate technologies such as online chat (text and/or video), discussion groups, and remote browser control
7. Help Desk and the CSRs annotate transactions with information regarding the help requested and the help provided
8. "Push" notifications to appropriate personnel when something changes

9.2 Requirements

9.2.1 All Documentation Available On-Line

All documentation needs to be available for easy access on-line. It will be in HTML, in a standard format. In the initial implementation, only an English version will be made available. Subsequent versions may deliver content in other languages. All documentation and help information will be displayed in a separate window, allowing the application windows to remain intact when help is requested. BMV staff needs access to the policies and procedures related to their jobs. The on-line version of documentation must be the master version. The content must be searchable. The search features should include:

1. Search by keyword or text
2. Restrict search to keyword only
3. Restrict search to certain types of documents
4. Include HTML documents in search
5. Present a result list

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6. Control of the modification of the documents is needed. Required controls include:
 - a. Control who can see a document.
 - b. Control who can modify a document.
 - c. Allow only one person to update a document at any one time
 - d. Multiple people have the ability to review an "in progress" document.
 - e. Documents must be approved before they are made available to non-reviewers.
 - f. Historical versions of documents.

9.2.2 Application Help Seamlessly Integrated into the On-Line Processes

Interactive on-line processing help is needed at various processing levels. The user interface for each level of help will be in a standard location and have a standard appearance. Interactive Help will be available to the CSRs at four levels:

- Individual field on a processing screen that describes the data entered in the field
- Screen/report help, which tells the user what function the screen performs or what the report content represents
- Business process documentation that describes a full business process, (such as "issue new drivers license") including such items as required documents and processing screens to be used
- Policy documentation integrated into the business process documentation by way of links to the appropriate policy or policies behind the process

The help information may be made available to the users based on user knowledge level, either novice or expert. This level can be selected by the user and will control how much automatic "prompting" the user gets while processing a transaction.

9.2.3 On-Demand Access to Application Error Message Documentation

On-line, on-demand access to a description of each error message in the IS21 application is required. This description would include information such as what kinds of actions or events trigger the error message and, when appropriate, possible solutions for resolving the problem.

9.2.4 Automation of the Help Desk to Track Issues to Completion

Help Desk calls will be logged into an automated tracking system. This permits management of the support requests to assure that issues are resolved to completion or until formally dropped.

9.2.5 Historical Help Desk Experience Used as Knowledge Management

Tracking the Help Desk support requests provides very useful information that can be used for purposes other than management of the requests until completion. The automated tracking system will also provide the information to be used as a Knowledge

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Management base. The information will be beneficial for any number of uses. Most obvious is for the Help Desk personnel, when presented with a support request, to see if a similar problem has previously been handled. If so, the information logged for the previous problem can be used to quickly determine the resolution needed for the current problem. Another benefit is that it can show historical patterns of problems that may need to be addressed by procedural and/or application changes.

9.2.6 Integrate Technologies Like Online Chat (Text and/or Video), Discussion Groups, and Remote Browser Control

When the Help Desk is working with a CSR on a problem, the Help Desk person is rarely at the CSR's location. It can be difficult for the Help Desk staff member to resolve a problem when the CSR's screen is processing differently than the Help Desk's. In addition, phone access is limited, restricting the ability for the Help Desk personnel and the CSRs to talk as much as needed in a timely manner. The proposed system will integrate technologies such as online chat (text and/or video), discussion groups, and remote browser control to allow more immediate interaction between the Help Desk and the branch personnel.

9.2.7 Help Desk and the CSRs Annotate Transactions with Information Regarding the Help Requested and the Help Provided.

The Help Desk requirements for an automated Help Desk tracking system will provide one aspect of historical information for problem tracking. Requirements also state that the application transactions provide the ability for the CSR and/or Help Desk personnel to annotate a transaction to provide historical information on help requested and received for that specific transaction.

9.2.8 "Push" Change Notification

Changes in policies, procedures, and other documentation are going to occur. It is important that affected personnel are notified of changes in a timely manner. The IS21 implementation needs to provide a pro-active manner in which to provide these notifications; it needs to "push" the change notification to the individuals who need to know, when they need to know.

9.3 Recommended Solution

9.3.1 Document Management

A Microsoft product called SharePoint Portal Server (SPS) will be used to provide document management functionality. SPS is a flexible portal solution that lets users find, share, and publish information easily. It permits users to search, retrieve, and manage documents using the standard Microsoft Internet Explorer browser that is used for the rest of the application. In addition, Windows Explorer document handling is possible in SPS, for those document management users who are more comfortable with it. The master documents for BMV policies and procedures will be controlled through SharePoint. SharePoint will also be used during the project development, as well as

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ongoing, to manage technical documentation for the IS21 application, and to manage other project related documents during the development of the project.

9.3.2 On-Line Help

Development of the on-line processing help needs to be consistent and provide a user-friendly interface to the application user. A product called RoboHELP Enterprise has been selected for preparation of the on-line help content. In general, BMV knowledge workers will provide the input for the help with technical staff using RoboHELP to turn this into formatted HTML documents. One licensed copy of RoboHELP is required for each technical writer on the project.

9.3.3 Application Error Message Documentation

Like the on-line help information, the error message documentation must be consistent and be provided via a user-friendly interface. This should require no additional technology. SPS alone or in conjunction with RoboHELP will cover this requirement.

9.3.4 Help Desk Automation

To support the tracking and knowledge management functions, the Help Desks will require Help Desk software. The selection and implementation of this will be a task for BMV. The IS21 consulting staff will be available for input in to the selection process.

9.3.5 Integrate Technologies Like Online Chat (Text and/or Video), Discussion Groups, and Remote Browser Control.

The Help Desks need tools that allow for timelier interfacing with the branch personnel for problem resolution. Tools that allow the Help Desk personnel to actually see the CSR's screen and that allow immediate, interactive "talking" between the Help Desk and branch need to be integrated into the application. The Microsoft software suite that is already in place, and that will be in place with the implementation of IS21, provides the necessary tools to perform this requirement. NetMeeting, MSN Chat, and SMS are examples of tools that could be used for this purpose.

9.3.6 Transaction Annotation

The re-design analysis has identified the need to track transaction assistance within the transaction itself. Design will include the functionality for both CSR and Help Desk personnel to enter information regarding help requested and received.

9.3.7 "Push" Change Notification

SharePoint Portal Server, identified in Section 9.3.1 for Document Management, can also be used to push change information to the end user. There are multiple ways in which this can be done. First, the Home Page of the SharePoint portal has an announcement section in which notices can be placed. Second, for documents that are searchable under SharePoint, a user can subscribe to items at a document level, a category level, or a folder level. Any time an item that falls within a user's subscription is

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modified, the Home Page of the portal will produce notification to this effect. Optionally, when a subscription is set up, the user can request that an email notification be sent when an item within the subscription changes.

For on-line, interactive help, a link can be placed on the affected screen(s) to a separate screen that explains the change.

10 Network Infrastructure and Topology

10.1 Network Architecture

The BMV uses a TCP/IP network to support its distributed computing operations. The physical topology of this network is in a state of transition from a carrier-provided frame relay interconnect to the Indiana Telecommunications Network (ITN) statewide network infrastructure. It is expected that the current frame-relay-based network will be completely replaced by the ITN-based network infrastructure prior to IS21 application deployment.

The Intellinet Commission of the State of Indiana administers the ITN infrastructure. ITN provides an integrated, high-speed voice and data network to eligible public sector agencies and institutions. The Intellinet Commission has partnered with the Indiana Higher Education Telecommunications System (IHETS) to design, build, operate, and maintain ITN. IHETS performs such functions as troubleshooting, customer support, break/fix, and engineering.

10.2 Current Network

The network infrastructure connecting BMV branch offices and other remote locations to the data center consists of a Sprint frame relay network. Dial backup is available through a central Cisco AS5200 access server via ISDN or, where ISDN is not available, standard analog (POTS) lines.

Table 10.1: Current Sites, Bandwidth, and Devices

Current Network (Sprint)			
Branch #	Branch Name	Circuit	# Devices
1	Albion	56K	7
2	Alexandria	56K	7
3	Anderson	128K	12
4	Angola	56K	9
6	Auburn	56K	7
8	Batesville	56K	6
9	Bedford	128K	11
11	Bicknell	56K	6
12	Bloomfield	56K	7
13	Bloomington	128K	11
14	Bluffton	56K	8
15	Boonville	56K	8
16	Amboy	56K	4
17	Brazil	56K	7
18	Brookville	56K	7
19	Brownstown	56K	6

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Current Network (Sprint)			
Branch #	Branch Name	Circuit	# Devices
20	Butler	56K	6
21	Cambridge City	56K	6
22	Newburgh	56K	7
25	Churubusco	56K	6
26	Clay City	56K	5
27	Clinton	56K	6
28	Columbia City	56K	8
29	Columbus	128K	18
30	Connersville	56K	9
32	Corydon	56K	9
34	Crawfordsville	128K	10
36	Crown Point	128K	10
37	Danville	56K	7
38	Decatur	56K	7
39	Delphi	56K	7
40	Dunkirk	56K	4
41	E. Chicago	128K	9
43	Elkhart	128K	11
44	Odon	56K	4
45	Elwood	56K	9
46	Indpls. South East St.	T1	12
47	Evansville (N) T.C.#939	128K	18
48	Fairmount	56K	7
49	Fortville	56K	15
50	Ft. Wayne (Southgate)	56K	5
51	Fowler	56K	9
52	Frankfort	56K	8
53	Franklin	56K	5
54	Garrett	56K	17
55	Gary	128K	5
58	Goshen	128K	12
59	Greencastle	56K	8
60	Greenfield	128K	10
61	Greensburg	56K	9
62	Greenwood	128K	14
63	Hammond	128K	14
64	Hartford City	56K	7
65	Hobart	128K	13
67	Huntington	128K	9
68	Albany	56K	9
70	Jasper	128K	9

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Current Network (Sprint)			
Branch #	Branch Name	Circuit	# Devices
71	Jeffersonville (T.C. #936)	128K	19
72	Kendallville	56K	8
73	Morocco	56K	6
75	Knox	56K	7
77	Lafayette (T.C. #938)	128K	21
78	Lagrange	56K	8
79	Laporte	128K	10
80	Lawrenceburg	128K	10
81	Lebanon	128K	10
82	Liberty	56K	5
84	Linton	56K	7
85	Logansport	128K	9
86	Lowell	56K	8
87	Madison	56K	9
88	Marion	128K	13
89	Martinsville	56K	9
90	Michigan City	128K	10
91	Middletown	56K	6
92	Mishawaka (T.C. #933)	128K	18
95	Monticello	56K	8
97	Morristown	56K	5
98	Mooreville	56K	8
99	Mt. Vernon	56K	7
100	Muncie (T.C. #935)	128K	20
101	Nappanee	56K	7
102	Nashville	56K	7
103	New Albany	128K	13
104	New Castle	128K	10
105	Noblesville	128K	12
106	North Judson	56K	5
107	North Manchester	56K	6
108	North Vernon	56K	8
110	Versailles	56K	6
111	Ellettsville	56K	8
112	Paoli	56K	8
113	Parker City	56K	4
114	Peru	128K	9
115	Plainfield	128K	9
116	Plymouth	128K	9
117	Portland	56K	7
118	Poseyville	56K	5

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Current Network (Sprint)			
Branch #	Branch Name	Circuit	# Devices
119	Princeton	128K	9
120	Rensselaer	56K	7
121	Richmond	128K	11
122	Ossian	56K	5
123	Rising Sun	56K	5
124	Rochester	56K	7
125	Rockport	56K	5
126	Rockville	56K	8
127	Rushville	56K	7
128	Salem	56K	8
129	Scottsburg	56K	9
130	Seymour	56K	8
132	Shelbyville	56K	9
134	Loogootee	56K	5
135	South Bend	128K	22
136	Spencer	56K	7
137	Sullivan	56K	7
138	Tell City	56K	7
139	Terre Haute (T.C. #931)	128K	22
140	Tipton	56K	7
141	Union City	56K	4
142	Valparaiso	128K	10
143	Veedersburg	56K	8
144	Vevay	56K	5
145	Vincennes	56K	10
146	Wabash	56K	8
148	Warsaw	128K	13
149	Washington	56K	7
151	Williamsport	56K	6
152	Winamac	56K	6
153	Winchester	56K	8
154	Petersburg	56K	6
160	Indpls. Special Sales/30th St.	T1	32
161	English	56K	7
164	Pendleton	56K	9
166	Brownsburg	56K	9
167	Griffith	128K	13
168	Syracuse	56K	7
170	Ft.Wayne (Pine V)	128K	19
172	Evansville (E)	128K	12
173	Evansville (W)	128K	11

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Current Network (Sprint)			
Branch #	Branch Name	Circuit	# Devices
176	Sellersburg	128K	16
179	Portage	128K	10
181	Walkerton	128K	11
182	Dale	56K	5
184	New Haven (T.C. #934)	128K	21
187	Kokomo	128K	14
190	Chesterton	56K	8
203	Indpls. Motor Pool (not on Sprint)	9.6K	1
206	Demotte	56K	7
227	Carmel	128K	11
231	Indpls. Lawrence (T.C. Br.#930)	T1	18
232	Indpls. Mail-In/16th St/Speedway (shared w/532)	T1	
233	Indpls., Michigan Rd. (T.C.)	T1	12
234	Indpls. Nora	T1	12
235	Indpls. Keystone/Midtown	T1	16
236	Merrillville	128K	9
237	Schererville	56K	13
240	Indpls. Speedway Br.	T1	45
241	Indpls. Beech Grove	T1	15
302	Summittville	56K	3
327	Cayuga	56K	4
329	Hope	56K	5
353	Edinburgh	56K	4
355	Gary R/C	128K	
364	Montpelier	56K	3
367	Warren	56K	3
404	Knightstown	56K	4
421	Hagerstown	56K	5
435	South Bend (Reg. Ctr.)	128K	
532	Indpls. Dealer 16th St/Speedway	T1	
535	Indpls. Dealer/Midtown/Keystone (shared w/232)	T1	

This network is currently in a state of transition and will be completely replaced by the ITN provided infrastructure well before IS21 application rollout.

10.3 Future Network

The ITN-based BVM/C network infrastructure will have been in place and operational for several months at the time of the IS21 application rollout. BMV sites will be connected via a fractional T1 to the nearest ITN Network Access Point (NAP); ten NAPs are geographically distributed throughout the state.

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Data will be transported over the ITN backbone ATM network to the State of Indiana campus, where DoIT will host the central IS21 server complex. Network availability is of concern, particularly for the local loop portion of the network (the connection from the individual branch to the NAP). It is understood that BMV is considering several alternatives, including satellite-based communications and traditional (POTS) dial backup, to allow processing to continue (although likely at reduced throughput) in the event of an extended local loop outage.

Table 10.2: Proposed Sites, Bandwidth, and Devices

Future Network (ITN)			
Branch #	Branch Name	Circuit	# Devices
1	Albion	128k	7
2	Alexandria	128k	7
3	Anderson	256K	12
4	Angola	128k	9
6	Auburn	128k	7
8	Batesville	128k	6
9	Bedford	256K	11
11	Bicknell	128k	6
12	Bloomfield	128k	7
13	Bloomington	256K	11
14	Bluffton	128k	8
15	Boonville	128k	8
16	Amboy	128k	4
17	Brazil	128k	7
18	Brookville	128k	7
19	Brownstown	128k	6
20	Butler	128k	6
21	Cambridge City	128k	6
22	Newburgh	128k	7
25	Churubusco	128k	6
26	Clay City	128k	5
27	Clinton	128k	6
28	Columbia City	128k	8
29	Columbus	256K	18
30	Connersville	128k	9
32	Corydon	128k	9
34	Crawfordsville	256K	10
36	Crown Point	256K	10
37	Danville	128k	7
38	Decatur	128k	7
39	Delphi	128k	7
40	Dunkirk	128k	4
41	E. Chicago	256K	9

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Future Network (ITN)			
Branch #	Branch Name	Circuit	# Devices
43	Elkhart	256K	11
44	Odon	128k	4
45	Elwood	128k	9
46	Indpls. South East St.	256K	12
47	Evansville (N) T.C.#939	256K	18
48	Fairmount	128k	7
49	Fortville	128k	
50	Ft. Wayne (Southgate)	256K	15
51	Fowler	128k	5
52	Frankfort	128k	9
53	Franklin	128k	8
54	Garrett	128k	5
55	Gary	256K	17
58	Goshen	256K	12
59	Greencastle	128k	8
60	Greenfield	256K	10
61	Greensburg	128k	9
62	Greenwood	256K	14
63	Hammond	256K	14
64	Hartford City	128k	7
65	Hobart	256K	13
67	Huntington	128k	9
68	Albany	128k	9
70	Jasper	256K	9
71	Jeffersonville (T.C. #936)	256K	19
72	Kendallville	128k	8
73	Morocco	128k	6
75	Knox	128k	7
77	Lafayette (T.C. #938)	256K	21
78	Lagrange	128k	8
79	Laporte	256K	10
80	Lawrenceburg	256K	10
81	Lebanon	256K	10
82	Liberty	128k	5
84	Linton	128k	7
85	Logansport	256K	9
86	Lowell	128k	8
87	Madison	128k	9
88	Marion	256K	13
89	Martinsville	128k	9
90	Michigan City	256K	10

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Future Network (ITN)			
Branch #	Branch Name	Circuit	# Devices
91	Middletown	128k	6
92	Mishawaka (T.C. #933)	256K	18
95	Monticello	128k	8
97	Morristown	128k	5
98	Mooreville	128k	8
99	Mt. Vernon	128k	7
100	Muncie (T.C. #935)	256K	20
101	Nappanee	128k	7
102	Nashville	128k	7
103	New Albany	256K	13
104	New Castle	256K	10
105	Noblesville	256K	12
106	North Judson	128k	5
107	North Manchester	128k	6
108	North Vernon	128k	8
110	Versailles	128k	6
111	Ellettsville	128k	8
112	Paoli	128k	8
113	Parker City	128k	4
114	Peru	256K	9
115	Plainfield	256K	9
116	Plymouth	256K	9
117	Portland	128k	7
118	Poseyville	128k	5
119	Princeton	256K	9
120	Rensselaer	128k	7
121	Richmond	256K	11
122	Ossian	128k	5
123	Rising Sun	128k	5
124	Rochester	128k	7
125	Rockport	128k	5
126	Rockville	128k	8
127	Rushville	128k	7
128	Salem	128k	8
129	Scottsburg	128k	9
130	Seymour	128k	8
132	Shelbyville	128k	9
134	Loogootee	128k	5
135	South Bend (shared w/435)	256K	22
136	Spencer	128k	7
137	Sullivan	128k	7

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Future Network (ITN)			
Branch #	Branch Name	Circuit	# Devices
138	Tell City	128k	7
139	Terre Haute (T.C. #931)	256K	22
140	Tipton	128k	7
141	Union City	128k	4
142	Valparaiso	256K	10
143	Veedersburg	128k	8
144	Vevay	128k	5
145	Vincennes	128k	10
146	Wabash	128k	8
148	Warsaw	256K	13
149	Washington	128k	7
151	Williamsport	128k	6
152	Winamac	128k	6
153	Winchester	128k	8
154	Petersburg	128k	6
160	Indpls. Special Sales/30th St.	256K	32
161	English	128k	7
164	Pendleton	128k	9
166	Brownsburg	128k	9
167	Griffith	256K	13
168	Syracuse	128k	7
170	Ft.Wayne (Pine V) (shared w/470)	256K	19
172	Evansville (E)	256K	12
173	Evansville (W)	256K	1
176	Sellersburg (shared w/476)	256K	16
179	Portage	256K	10
181	Walkerton	256K	11
182	Dale	128k	5
184	New Haven (T.C. #934)	256K	21
187	Kokomo	256K	14
190	Chesterton	128k	8
203	Indpls. Motor Pool	56k	1
205	Indpls. Fleet Max	56K	4
206	Demotte	128k	7
227	Carmel	256K	11
231	Indpls. Lawrence (T.C. Br.#930)	256K	18
232	Indpls. Mail-In/16th St/Speedway (shared w/240 & 532)	256K	45
233	Indpls., Michigan Rd. (T.C.)	256K	12
234	Indpls. Nora	256K	12
235	Indpls. Keystone/Midtown (shared w/535)	256K	16
236	Merrillville	256K	9

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Future Network (ITN)			
Branch #	Branch Name	Circuit	# Devices
237	Schererville	128k	13
239	Indpls. Virginia Ave. (shared w/999)	256K	25
240	Indpls. Speedway Br. (shared w/232 & 532)	256K	
241	Indpls. Beech Grove	256K	15
302	Summittville	128k	3
327	Cayuga	128k	4
329	Hope	128k	5
338	Berne (was #10)	128k	5
353	Edinburgh	128K	4
355	Gary R/C (shared w/55)	256K	
364	Montpelier	128k	3
367	Warren	128k	3
404	Knightstown	128k	4
421	Hagerstown	128k	5
435	South Bend (Reg. Ctr.) (shared w/135)	256K	
470	Ft. Wayne (Reg. Ctr.) (shared w/170)	256K	
476	Sellersburg (Reg. Ctr.) (shared w/176)	256K	
532	Indpls. Dealer 16th St/Speedway (shared w/232 & 240)	256K	
535	Indpls. Dealer/Midtown/Keystone (shared w/235)	256K	
999	Indpls. Virginia Ave. (Reg. Ctr.) (shared w/239)	256K	

BMV is replacing the extant BOSS system running on CTOS with a rewrite of the application running on Windows. This BOSS migration project will deploy the resulting application on Windows NT Terminal Services Edition, utilizing Citrix Metaframe and the ICA protocol for server load balancing. The BOSS migration application will be accessed over the ITN network from workstations configured as thin client devices. The BOSS migration application will run on centrally-hosted servers, allowing the bulk of the back-end application data traffic to remain within the central system high-speed Local Area Network (LAN). Only the user interface will be presented at the thin client device, limiting the traffic over the bandwidth-limited Wide Area Network (WAN) to screen data, keystrokes, and mouse movement and cursor position information.

The deployment of the BOSS migration application over the ITN-based network will give a fair approximation of the IS21 network demands, due to the similar division of central LAN traffic (application server and database server traffic) and WAN traffic (HTML pages and form postings). Network latency will be less of an issue for the browser-based IS21 application than for BOSS migration application responsiveness; however, total bandwidth demands of the IS21 application may be greater.

The specific network demands of the IS21 application will be characterized during detail design and assessed as the application is prototyped. This will allow any additional demands placed upon the network to be anticipated and any potential resource constraints identified and addressed by BMV prior to IS21 application rollout.

11 Security

Security is one of the primary concerns within any environment. Practices will be observed at various levels to ensure a secure working environment for IS21 applications. The security architecture supporting the IS21 application will be based on Windows 2000 Active Directory services.

11.1 Active Directory

11.1.1 Authentication

Active Directory provides authentication services for network and applications (challenge/response, Kerberos, certificate-based, or smart-card based); authentication ensures a user is indeed who s/he claims to be.

11.1.2 Authorization

Active Directory will hold attributes (group membership and role information) that will determine the methods a given user may access (and therefore the transactions they may complete).

11.1.3 Administration

Active Directory services will be employed in the management of user objects and their attributes (either through Active Directory tools or under programmatic control through standard system services and programming interfaces, e.g. through a web-based form). Active Directory will also be used to store information about printers, servers, and other network resources.

11.2 Single Sign-On Event

User will be required to authenticate (to Active Directory) once per session. Authorization to use systems and services will be granted based on information stored in Active Directory.

11.3 n-Tier Application Security Implications

In a typical client-server application environment, access to data is granted (or restricted) by the database using table and/or field level security attributes on a user or group basis. In an n-tier application environment, the database cannot manage security in this way, as a middle-tier application component accesses the database on behalf of the user. Therefore, the application must implement security and data access restrictions, not the database engine. We have chosen to base these decisions on role-based security information stored as an attribute of the user object in the Windows 2000 Active Directory. Because this role-based information is stored in Active Directory (and not embedded within the application nor the database), other network applications and

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services can make use of this information (e.g. Microsoft Exchange, SharePoint, or basic File and Print Services).

11.4 Role-Based Security

The IS21 application will control an individual user's ability to access a particular method based on the user's role within the organization (e.g. Branch Manager, CSR, Expediter, etc). Role attributes will be associated with an individual user through an object relationship stored in the Windows 2000 Active Directory. An individual user may hold many roles. Roles are also location dependent. For example, the Nora Branch Manager may serve as a CSR in the Speedway branch to help out in a crunch; therefore, she may have more capabilities when signed on in the Nora branch than when signed on to a workstation in the Speedway branch.

11.5 Security Management

Management of IS21 application security will be web based. A web interface will be constructed, which will allow assignment of roles to users (manipulating objects within Active Directory). Organizational rules will define who may assign roles, and what roles they have the right to assign.

12 Document Imaging

It is necessary to store transaction-related documents for up to ten years. The documents may be original documents or copies of customer documents. Currently, the branches send the documents to BMV's central office. BMV then images these documents on microfilm (or microfiche; further reference to microfilm should also be interpreted to include microfiche as appropriate). The microfilm is sent to DoIT for development. The developed microfilm is returned to BMV and checked to ensure that the documents were filmed correctly. The microfilm is stored at BMV's central office for ten years. The original documents are stored until microfilm is verified and then shredded. Retrieval of documents is limited to the BMV central office, delaying processing when historical documents are required. The proposed re-engineered process calls for the documents to be stored as digital images.

12.1 Digital Imaging Process

At least initially, most of the image processing will continue to be done by BMV. CSRs will create a transactional identifier for the documents related to the transaction. This identifier could be a header page or bar code strips that go onto each document. The identifier, along with the documents, will be sent to BMV for scanning. The scanned images will be stored in an image database where they will be accessible on demand and backed up using normal data store backups.

The digital images provide several advantages:

1. The documents are quickly retrievable by branch employees, removing the delay for BMV to look up the documents on microfilm.
2. Multiple people can view the same documents at the same time. This permits a CSR to work with a customer at the branch with real time communication to BMV central office, which can look at the same documents while helping to resolve the issue.
3. Document quality can be immediately confirmed during the scanning process.
4. Document quality of scanned items is typically better than microfilm images.
5. Color can be retained, including shadings used for security.
6. Images can be indexed by identifiers other than just transaction ID; they can be indexed and retrieved based on driver's license number, name, vehicle, license plate, and other pertinent information.
7. Reinstatement centers, which now do their own microfilming, will do their own scanning. Large branches could also be provided with scanners to do their own imaging. In the long term, if it is deemed desirable, all branches could do their own imaging. It is anticipated that large branches would need a dedicated staff person to do the scanning. Smaller offices would most likely be able to handle this with existing staff.

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12.2 Conversion of Documents on Microfilm

Converting all documents currently on microfilm would be a very time-consuming process. Unisys does not recommend that this be done. With the ten-year retention

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requirement, all existing microfilm would be eliminated within ten years of scanning implementation. It is recommended that when documents have to be looked up on microfilm, the documents be converted to digital images at that time. The premise behind this is that if a transaction has to be retrieved once, there is a strong likelihood that, for some types of documents, it would need to be pulled again at another time. If desired, other microfilmed documents could be converted to digital images on a gradual basis as staffing availability permits.

12.3 Technology Requirements

The scanners used for this purpose will need to be able to handle color, scan double-sided documents, and scan documents of different sizes and shapes. The technology to be used must generate a standard image format to assure that the documents can be read during the life of their required retention, even if the vendor abandons the scanners selected for IS21. Each branch that will do its own scanning will require at least one scanner and associated server technology. Vehicle Services and Drivers Services will need adequate equipment to handle the remaining microfilming. Detail design will address the specific imaging solution to be deployed and the exact equipment required at each location.

13 Third-Party Software

13.1 Background

IS21 will require the acquisition and use of third-party software and services to enhance the custom code developed for the application. The table below summarizes the third-party requirements that have been identified. Selection of specific products for some applications will be done in later phases of the IS21 project.

13.2 Third-Party Software Requirements

Table 13.1: Third-Party Software

Purpose	Selected Product	Phase
Address editing and standardization	Will be selected in Phase 2	2
Barcode software	Will be provided with hardware selection in Phase 2	2
Boat valuation software	ABoss by InterTec	2
Electronic lien checking	AAMVA Electronic Lien	Future
Imaging	Potential future selection by the BMV	Future
Signature capture software	Will be provided with hardware selection in Phase 2	2
Social Security Number verification	Cost justification is being considered by BMV during Phase 1. AAMVA SSOLV is possible solution.	TBD
Vehicle valuation software	Will be selected in Phase 2	2
VIN verification software	Polk's VINA has been selected	2
UNI	Used to interface with PDPS, CLDIS and NMVTIS	TBD
Customer queuing software and hardware	Technology selection will occur in Phase 2. It is possible that no external hardware/software will be used.	2
Handheld warehouse scanners	Existing Radio Frequency (RF) interface to handheld scanners	2
Cash drawer operation	Software control of the CSR cash drawers	2
Help Desk tracking	Software to track Help Desk calls	TBD

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13.3 Estimated Costs

Table 17.2: Other Costs

Item	Qty	Unit Cost	Total	Phase	Comments
RoboHELP Server license	1	\$1,898	\$1,898		
RoboHELP Documentation license	10	\$898	\$8,980		\$898/license - probably 10=\$8980
Chat/CSR-HD interaction			0		Utilize MSN chat and SMS – no cost
Help Desk software	25	\$1,500	\$37,500		For 25 users, including MVIS and functional area support
Anti-virus software			0		Part of BOSS migration rollout
Crystal Reports	1	\$100,000	\$100,000		For developers & ad hoc; 4 server license
Address validation	1	\$200,000	\$200,000		Transaction based system - quotes based on 10M txns/trly, initial license 20K-1 time fee & 15K/month 180K per year after first year
Check verification			0		Not an issue for costing in the IS21 project as already do it
VIN validation software			0		TBD
AAMVA Electronic Lien	1	\$22,000	\$22,000		2,000 per year service (first year included); assumption: business partners pay own expense
Barcode software		0	0		No separate software required
Signature capture software		0	0		No separate software required
Testing software					
Licensing	1	\$26,000	\$26,000		10 testers
Training	1	\$13,000	\$13,000		10 testers
Ad hoc reporting			0		Included in Crystal Reports above
MVIS Staff Training					
Advanced staff	56	\$2,500	\$140,000		7 people; 8 weeks per
Other staff	44	\$2,500	\$110,000		11 people; 4 weeks per
MSDN Library			0		Available free on-line

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14 External Interfaces

14.1 Background

IS21 will be required to interface with other applications. These are listed below.

14.2 External Interface Requirements

Table 14.1: External Interfaces

Interface	Purpose	Usage	Phase
DDL	Produce driver's license cards	Output	2
Dept. of Revenue	Create a vehicle lien for outstanding tax payments	Output/Input	2
FSSA	Create of a vehicle lien for outstanding child support payments	Output/Input	2
FSSA	Suspension of driver's license for outstanding child support payments	Output/Input	Future
Prison Industry (PIN Products)	Generate electronic purchase order for plates	Output	2
Self Service terminals	Interface to IS21 business logic to support self-service terminal transactions	Input/Output	TBD
Public Internet	Interface to IS21 business logic to support self-service internet transactions (hosted by AccessIndiana)	Input/Output	TBD
Board of Health	Receive death information to update records	Input	TBD
CDLIS	Various commercial driver's license verifications and information exchange	Input/Output	2
Courts	Retrieve court citation/judgment information	Input	TBD
Courts	Provide defensive driving information	Output	TBD
Enviro Test	Send vehicle information for potential testing; receive test results	Output/Input	2
GMIS/Peoplesoft	Purchase Orders, HR/Payroll, GL Postings	Input/Output	TBD
IDACS/NCIC	Stolen vehicle check		2
PDPS (National Problem Driver Point System)	Various driver's license verifications and information exchange	Input/Output	2
Organ procurement programs	Provide information of donor participation to national database	Output	Future
NMVTIS	Various vehicle verifications and information exchange	Input/Output	2
AIPS	Defensive driving class results	Input	TBD
Indiana State Police	Potential Stolen Vehicle data exchange	Input/Output	TBD

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Interface	Purpose	Usage	Phase
Law Enforcement	Selected personnel can enter form 322 information to report abandoned vehicles	Input/Output	TBD
Auditor	Refund check requests	Output/Input	2
Financial Institutions	ACH requests for the transfer of funds	Output/Input	2
Microfilm	Suspension notices, court abstracts, FSSA notifications, and driver letters are output directly to microfilm using ComFilm	Output	TBD
State Board of Health	Verify doctor's license for CDL examinations (file from AccessIndiana)	Input	Future
County Auditors	Provide excise tax details	Output	
Insurance Companies	Import SR-22 and SR-26 information	Input	TBD
Insurance Companies	Provide vehicle and driver information via FTP (Access Indiana)	Output	TBD
CarFax ComPlus Data Info Link Tech Pacific Institute for Research & Evaluation Statistical Survey TRW	Vehicle and driver information	Output	TBD
Credit card authorization	Process credit card payments	Input	2

15 Systems Management

Any business system must be managed to ensure that it is meeting the business needs of the organization; this is as true of automated systems as it is of manual processes.

Successful business process managers do not deploy a new process without insisting that adequate management reporting and controls are in place. Business process management reporting and controls are being designed into the various subsystems of the IS21 project, based on the best practices of subject matter experts involved in the design process, to ensure the integrity and manageability of the systems.

Successful information systems managers do not deploy new systems and services without ensuring that adequate management reporting and control mechanisms are in place. Several tools are available to collect performance and utilization data on the systems and services that will be deployed as part of the IS21 project. The Windows 2000 operating system provides enhanced management capabilities for desktop workstations and central server systems.

Additional tools, such as Systems Management Server (SMS), Microsoft Operations Management (MOM), and Application Center 2000 complement and enhance management features integrated with the Windows 2000 operating system to provide increased management, reporting, and control functionality. These products are part of Microsoft's overall systems management strategy, and are built upon the Microsoft .NET management services. Each of these products addresses a different area of IT systems management; taken together, they complement the management technologies built into the Windows 2000 operating system and comprise a complete set of management solutions for the IS21 environment.

15.1 Windows 2000 Management Features

Windows 2000 incorporates several integrated management features that enhance the ability of the system administrator to centrally manage, monitor, and control Windows 2000 workstations and servers deployed throughout the enterprise. A few Windows 2000 management features relevant to the deployment of the IS21 project are discussed here.

15.1.1 Active Directory

Active Directory is an integral part of Windows 2000 Server that enables essential network system services; it is the focal point for managing users, applications, servers, and devices, and it is a trusted repository of security data for authentication and authorization.

Active Directory contains information about all of the key components of the network and defines their organization and relationships with each other. As such, Active Directory is a key component of Windows 2000 system management. Many of the management features of Windows 2000 are built on the services provided by Active Directory.

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15.1.2 Group Policy and IntelliMirror™

Group Policy is used to define user and computer configurations for groups of users and computers. A specific desktop configuration can be defined using the Group Policy Microsoft Management Console (MMC) snap-in. Registry-based policies (pertaining to the operating system and applications), security options, software installation and maintenance options, scripts options (computer startup, shutdown; user logon, logoff), and folder redirection options are all controlled through the MMC Group Policy snap-in.

Group Policy settings are stored in Active Directory and associated with a container object (site, domain, or organizational unit) within the directory. This allows an administrator to define the state of the user environment once for a group of users, and then rely on Windows 2000 to enforce the defined policy.

IntelliMirror™ is a set of management technologies integrated into Windows 2000 that allows users' data, applications, and personal settings to follow them to any desktop on the network. The three core features of IntelliMirror™ are user data management, software installation and maintenance, and user settings management. These features can be used, individually or in combination, to provide policy-based user desktop management. Group Policy and IntelliMirror™ facilitate Windows 2000 desktop change and configuration management. Bandwidth constraints of the BMV network will limit the extent to which these features of Windows 2000 may be exploited.

15.1.3 Remote Installation Services

Windows 2000 Remote Installation Services (RIS) facilitate Remote Operating System Installation. Systems administrators can use the new pre-boot execution environment (PXE) technology and server-based distribution software to automate the installation of the Windows 2000 Professional operating system on client computers. Either the network equivalent of a CD-based installation or a pre-configured Remote Installation Preparation (RIPrep) desktop image may be installed in this manner.

While bandwidth constraints of the BMV network will limit the usefulness of this feature in the field, it may be exploited in the initial system rollout to quickly build client workstations with a standard system and application configuration.

15.1.4 SysPrep Utility

Remote OS Installation facilitates the configuration and deployment of Windows 2000 Professional Workstation systems. The SysPrep utility, available in the Windows 2000 Server resource kit, allows a system administrator to automate the process of building a completely configured Windows 2000 Server system.

Several identically configured servers will be deployed in the middle tiers of the IS21 system's n-tier architecture. The SysPrep utility may be used to facilitate the configuration and deployment of these servers, ensuring that the system configuration of each is indeed the same.

15.2 Systems Management Server (SMS)

Systems Management Services (SMS) version 2.0 (SP3) enhances and extends the management capabilities integrated into the Windows 2000 operating system. SMS provides advanced change and configuration management features for enterprise-wide deployment of services that complement those integrated into Windows 2000.

The primary feature of SMS required for the IS21 application deployment is the SMS remote diagnostic tool set. These tools include Remote Control and Remote Reboot. Centralized help desk and support personnel will use these tools to assist CSRs in branch offices.

15.2.1 Remote Control

The SMS Remote Tools Client Agent provides remote access to the client desktop via the Remote Control tool. A taskbar indicator can appear in the system tray on the client machine to indicate the current status of the Remote Control session (no session, session active, session paused). The Remote Tools Client Agent can be configured to specify which users may initiate a Remote Control session, as well as to limit the level of access allowed. Help Desk personnel may use the Remote Control tool to walk a CSR through an unfamiliar procedure, or to diagnose a problem the user is experiencing.

15.2.2 Remote Reboot

The SMS Remote Tools Client Agent provides the ability to remotely reboot a client computer. This can also be done from within a Remote Control session, allowing the operator to monitor the shutdown process; the Remote Control session is not closed until the client actually reboots, allowing the operator to observe programs that fail to shut down, open data files, or other problems.

The SMS Remote Tool Client Agent will be installed on each workstation that will access the IS21 application. Additional SMS tools support the full range of desktop system management, including planning, deployment, hardware and software inventory, and software distribution and maintenance. While integrated Windows 2000 features, including IntelliMirror™ and Remote OS Installation, are sufficient for change and configuration control in a simple local area network (LAN), a more distributed and complex deployment will benefit from the additional capabilities SMS provides.

15.3 Microsoft Operations Management (MOM)

While Systems Management Server enhances change and configuration management for desktops and servers, Microsoft Operations Manager 2000 (MOM) delivers comprehensive server and application operations management. MOM is based upon technologies licensed from NetIQ Corporation. MOM provides several features that simplify the management of multiple servers:

- **Consolidated event management** for Windows 2000 Server, Active Directory, Internet Information Services (IIS), .NET Enterprise Servers (including Microsoft Exchange Server and SQL Server) through an enterprise

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event log that collects and reports on problems and information generated from systems and applications across the corporate network.

- **Proactive monitoring and alert messaging** through distributed capabilities that can track and monitor information and send problem notifications to pagers or through e-mail. These alerts can optionally be configured to trigger scripts to automatically resolve the problem.
- **Reporting and trend analysis** that can be used to track problems over time and generate detailed reports on the overall health on the managed environment. These reports can either be accessed locally or published on web sites for improved access to systems management information.
- **Domain-specific operations management** through detailed management packs for many different Microsoft technologies and products, including Windows 2000 Server, Active Directory, IIS, Terminal Services, Microsoft Distributed Transaction Coordinator (MDTC), Windows Internet Naming Service (WINS), Dynamic Host Configuration Protocol (DHCP), Domain Name Service (DNS), Microsoft Transaction Service (MTS), Microsoft Message Queuing (MSMQ), Exchange Server, Microsoft SQL Server, Systems Management Server and Host Integration Server. Additional non-Microsoft management packs are available from third parties, such as NetIQ.

Microsoft Operations Management services will be used to monitor and manage the various servers in the Presentation, Business Logic, and Database tiers of the IS21 application.

15.3 Application Center 2000

Application Center 2000 will be used to cluster and manage the servers in each of the Presentation, Business Logic, and Database tiers of the IS21 application. Application Center is designed specifically for those enterprises that deploy and manage high-availability Web- and component-based applications built on the Windows 2000 operating system. It includes tools to facilitate the creation, management, and monitoring of Windows server clusters.

Application Center resides on each server in the cluster. The administrator manages Windows clusters and individual cluster members using the Application Center 2000 snap-in to the Microsoft Management Console (MMC). The MMC snap-in may be run on any cluster member server, or any computer running Windows 2000. The Application Center MMC snap-in offers individual or aggregated views of performance, health, and event data across the entire cluster.

Application Center provides cluster-specific services on each cluster member server, including:

- **Administrative Services** are invoked through the various management interfaces
- **Synchronization Services** coordinate the replication of content, components and configuration settings throughout the cluster
- **Logging and Query Services** give visibility to performance, health and event information for any cluster server

A browser-based administrative tool, the Browser Console, is also available. It provides the ability to monitor the cluster from any client with a browser. This streamlined version

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of the MMC snap-in allows monitoring performance, health and event information for a single server or the entire cluster. Limited administrative tasks may also be performed using the Browser Console.

A primary objective of Application Center 2000 is to make managing groups of servers as simple as managing a single computer. Administrative tasks are automated and streamlined where possible, including tasks related to application management, software scaling, and mission-critical availability.

15.3.1 Application Management

Application Center 2000 facilitates the application deployment process, reducing the complexity and cost of operating a scalable, highly available application.

- **Reduces application management complexity.** The IS21 application will consist of many bits and pieces. Application Center provides the capability to construct logical groupings including the contents, components, and configuration of the IS21 application. These groupings can be easily managed throughout the cluster, reducing application management complexity.
- **Manages many servers as one.** When changes are made to a server, Application Center can automatically apply those changes to the other servers in the cluster. This reduces the amount of tedious, repetitive work required to deploy application components and changes, which also reduces the chance for administrative error and ensures consistency among cluster member servers.
- **Streamlines application deployment.** Application Center can be used to simplify the task of migrating IS21 application components through the development cycle (from development to testing to production). This will help ensure consistency between the developed application, the tested application, and the production application. By automating deployment of applications from one server to another, Application Center reduces the time required to manage and deploy application components, eliminates manual errors, and improves the overall quality of the application deployment environment.

15.3.2 Software Scaling

Software scaling manages the capacity of an application by adding or subtracting servers from the cluster. While hardware scaling requires expensive, specialized servers, software scaling can be achieved using standard off-the-shelf servers. In addition, with software scaling, the relationship of cost to added capacity is close to linear.

Application Center simplifies software scaling of the Business Logic tier of the IS21 application through clustering. Resources can be managed to adapt to changing business logic processing requirements as needed.

15.3.3 Mission-Critical Availability

Application Center is designed so that any server may be brought down without affecting the availability of the application; there is no single point of failure. This will allow the IS21 application environment to tolerate software and hardware failures in any tier of the system with minimal impact on application service.

Application Center also facilitates the administration of rolling upgrades to systems and components by allowing cluster member servers to be easily removed from and added back into the cluster.

Application Center can monitor server and application health and can take action in response to particular events and conditions. Automated responses to events can contribute to higher overall application availability.

15.4 Internet Explorer Administration Kit (IEAK)

The Internet Explorer Administration Kit (IEAK) is a tool designed to enable administrators to create a hands-free customized installation of Microsoft Internet Explorer. Using the Internet Explorer Administration Kit, administrators can:

- Tailor browsers and other Internet components to fit an organization's needs—for example, by customizing the Links bar and Favorite lists to promote the organization or provide helpful information
- Configure settings before an installation, so administrators don't need to set options on each computer
- Customize Setup so that it requires less intervention and installs custom programs
- Manage which settings users can change, to ensure that security, connection, and other important settings adhere to corporate standards

The IS21 application will be browser-based; the IEAK provides a means by which BMV may create an Internet Explorer installation specific to its needs.

16 Disaster Recovery and Business Continuity

Deployment of the IS21 application will have implications for disaster recovery and business continuity processes and procedures at all levels of BMV.

Existing plans and procedures will need to be reviewed in light of how certain business processes will change. Some changes will be necessary prior to deployment of the IS21 application; the BOSS reengineering project currently underway will fundamentally change the way certain processes occur. For instance, the availability of the data network will be paramount to the ability to do business in an individual branch, altering the current "local processing" level of the existing business continuity plan.

BMV must ensure that the implications regarding disaster recovery and business continuity are well understood and are factored into the service level agreements negotiated with other service organizations (DoIT, IHETS).

16.1 Branch Operations

The n-tier, browser-based architecture of the IS21 application design distributes the user interface and printing operations to the branch location. Application components are accessed through the client web browser. No program logic or data is permanently stored on the workstation in the branch.

The branch is reliant upon the availability of the network to access the centralized web and application servers. A data network communications failure will leave the branch unable to process any transaction; redundant data links and/or dial back-up data communications methods must be designated to allow a branch to continue operations (perhaps at reduced capacity) in the event of an extended network outage.

Failure of an individual workstation or printer should have limited impact upon branch operations. This is the most likely event, and would be handled as a routine event (service call placed through help desk operations, problem diagnosed, and the failed component or device repaired or replaced).

16.2 Centralized Operations

The n-tier, browser-based architecture of the IS21 application design inherently centralizes the bulk of the data processing and storage operations associated with the application. Each tier of the application is designed to support the enhanced system availability features provided by the Windows 2000 Advanced Server and Datacenter Server operating system distributions.

16.2.1 Windows Clustering

Utilizing Windows Clustering features will ensure high availability of IS21 servers. Clustering refers to the technique of linking individual servers together, both physically

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and programmatically, and coordinating communication between them so they can perform common tasks.

Two types of clustering available in Windows 2000 will be used in the IS21 deployment:

- **Cluster Service** is primarily used to provide failover support for databases, messaging systems, and file/print services. Cluster service supports two-node failover clusters in Windows 2000 Advanced Server and four-node clusters in Datacenter Server. Cluster Service will be used to ensure high availability of the SQL Server database platform supporting the IS21 application.
- **Network Load Balancing (NLB)** balances incoming IP traffic across clusters of up to 32 nodes. NLB is used to enhance both the availability and scalability of Internet server-based programs. NLB will be used to ensure high availability of the web and application servers supporting the IS21 application.

16.2.2 Presentation Tier

The web servers supporting the presentation tier will utilize Network (TCP/IP) Load Balancing to distribute the load among two (or more) servers. The servers will be sized and managed to provide n+1 redundancy. Sufficient capacity will be available to handle the anticipated load should one server be unavailable. This will ensure the continuous availability of the application in the event of a hardware or software failure on one node of the Presentation Tier cluster, as well as provide for the ability to perform rolling upgrades to hardware or software on Presentation Tier servers without impacting overall system availability or performance.

16.2.3 Business Logic Tier

The application servers supporting the presentation tier will utilize Application Center to manage the Network Load Balancing architecture in the Business Logic Tier of the IS21 application. The servers will be sized and managed to provide n+1 redundancy in this tier. Sufficient capacity will be available to handle the anticipated load should any one server be unavailable. This will ensure the continuous availability of the application in the event of a hardware or software failure on one node of the Business Logic Tier cluster, as well as provide for the ability to perform rolling upgrades to hardware or software on Business Logic Tier servers without impacting overall system availability or performance.

16.2.4 Database Tier

The database servers supporting the IS21 application will be configured in an active/passive failover cluster utilizing the integrated Cluster Service of Windows 2000 Advanced Server or Datacenter Server. Should a hardware or software failure occur on the active node, the standby or passive node will pick up the processing node. Cluster Service utilizes a shared-disk configuration with a common bus architecture (such as SCSI and Fibre Channel) to ensure that no data is lost during a fail-over event. Cluster Service also supports rolling upgrades to hardware or software without impacting overall system availability or performance.

A1 Appendix A: Microsoft's Web Solution Platform

(Content from <http://microsoft.com/business/products/webplatform/overview.asp> on 6/12/01)

What is Microsoft's Web Solution Platform?

Microsoft's current Web solution platform (formerly known as Windows DNA) allows you to focus on solving business needs rather than on building basic plumbing. It consists of a combination of Microsoft products and technologies that, when used together, can help your company fully use the power of the Web. The products in this Web solution platform are available today and will provide you with a valuable set of tools for building applications that get to market quickly, integrate with systems you already have, and evolve over time.

Microsoft is, at the same time, evolving this platform to enable a new generation of Internet applications and services. The new platform, which is considerably broader in scope, is known as .NET. A core piece of Microsoft® .NET is a set of products, called the .NET Enterprise Servers, which will augment and improve upon Microsoft's existing server products.

The Road to .NET

The chart below depicts [the evolution of Windows DNA to .NET](#). You can quickly see the products in the platform, the role they play, and the new .NET Enterprise Server products that will play a similar role within .NET.

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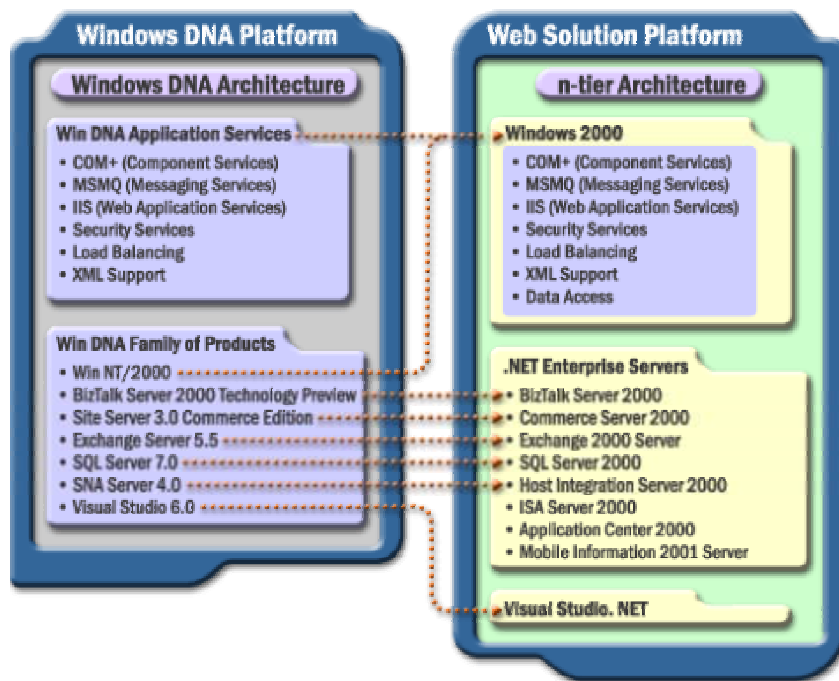


Figure A1.1: The Evolution of Windows DNA to .NET

The diagram below shows the relationship of these products, along with the underlying Component Object Model (COM) component architecture, to the structure of a Web application. The .NET Enterprise Servers are shown, but this relationship also holds true for previously released products—for example, Microsoft SQL Server™ 7.0—that are precursors to a .NET Enterprise Server.

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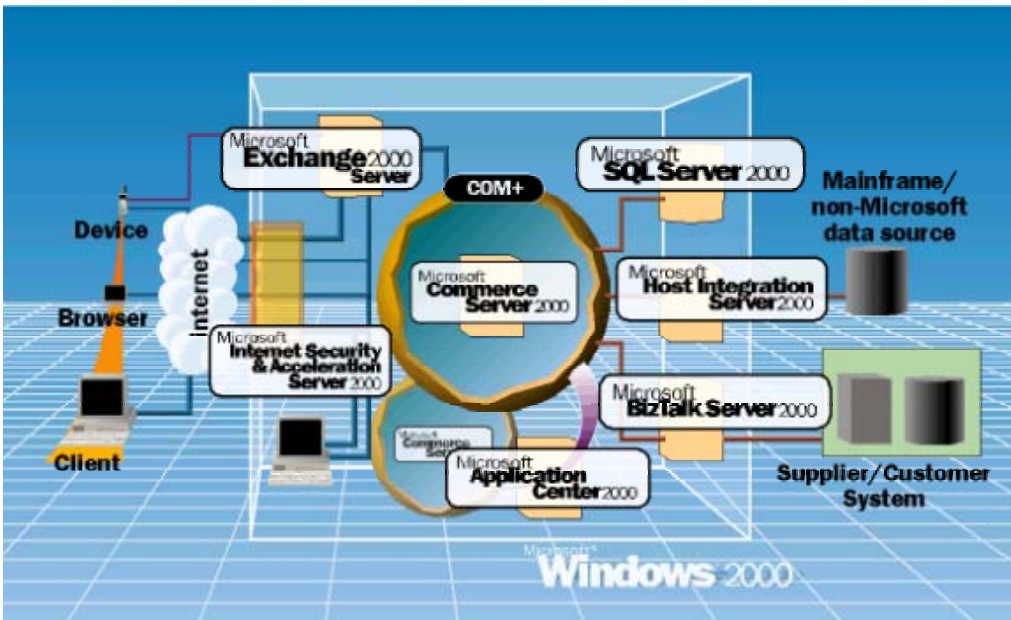


Figure A1.2: Relationships Between Microsoft Products

What Can It Do?

Microsoft's Web solution platform enables every aspect of Web solution development, including:

- Component and transaction management.
- Web page serving and scripting.
- Messaging support.
- Security.
- XML parsing.
- Data management and warehousing.
- Integration with third-party data sources and systems.
- Information exchange and workflow management using XML.
- E-commerce application building blocks.
- Server cluster management.
- Messaging and collaboration.
- Firewall and caching.
- Development tools.

See the Web & application services page for more detail about how the services in Microsoft Windows® 2000 work as part of the Web solution platform.

A2 Appendix B: Windows 2000 Accessibility Features

(Content from <http://www.microsoft.com/enable/products/windows2000/features.htm> on 6/12/01)

Microsoft® Windows® 2000 features several useful new accessibility tools to help people with disabilities configure and use business computers quickly—without additional software and hardware. Accessibility features from earlier releases of the Windows operating system are still there, and with the increased integration of Microsoft Active Accessibility®, many accessibility aids simply work better.

Enhanced Accessibility Menu

Two new accessibility utilities, Narrator and On-screen Keyboard, together with the previously introduced Magnifier, are installed by default in Windows 2000. They appear along with the Accessibility Wizard and the Utility Manager in the expanded Windows 2000 Accessibility menu, which can be accessed through the Start menu.

Utility Manager

Utility Manager brings all of the Windows 2000 Accessibility programs—Narrator, Magnifier, and On-screen Keyboard—together in one place. You can quickly check the status of an individual program, or start and stop any or all of them. If you have administrator-level access, you can assign programs to start when Windows 2000 starts.

On-Screen Keyboard

On-screen Keyboard displays a virtual keyboard on the computer screen that enables people with mobility impairments to type data by using a pointing device or joystick. On-screen Keyboard provides a minimum level of functionality for some people with mobility impairments. It can also help people who do not know how to type.

With On-screen Keyboard you can choose from three typing modes:

- **Clicking.** Select the on-screen keys to type text.
- **Scanning.** Type keyboard characters by pressing a hot key or by using a switch-input device as On-screen Keyboard scans and highlights areas of the keyboard.
- **Hovering.** Point to a key by using a mouse or joystick for a pre-defined period of time, and the selected character is typed automatically.

On-screen Keyboard also allows you to:

- View an enhanced keyboard that includes the numeric keypad, or view a standard keyboard without the numeric keypad.
- Display the keyboard with the keys in the standard layout, or in a block layout in which the keys are arranged in rectangular blocks.
- Display the U.S. standard keyboard (101 keys), the universal keyboard (102 keys), or a keyboard with additional Japanese language characters (106 keys).
- Select Click Sound to add an audible click when a key is selected.
- Select Always on Top to keep the keyboard displayed on the screen when switching programs or windows.

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Narrator

Narrator is a text-to-speech utility for people who are blind or have low vision. Narrator reads what is displayed on the screen—the contents of the active window, menu options, or text that has been typed.

Narrator is designed to work with Notepad, WordPad, Control Panel programs, Internet Explorer, and some parts of Windows 2000 Setup. Narrator has a number of options that allow you to customize the way screen elements are read. You can:

- Hear new windows, menus, or shortcut menus read aloud when they are displayed.
- Hear typed characters read aloud.
- Watch the mouse pointer follow the active item on the screen.
- Adjust the speed, volume, and pitch of the voice.

Magnifier

Magnifier is a display utility that makes the computer screen more readable for people who have low vision. Magnifier creates a separate window that displays a magnified portion of the screen. Magnifier provides a minimum level of functionality for people with slight visual impairments. Magnifier enables you to:

- Adjust the magnification level of text and images in the magnification window.
- Change the size and location of the magnification window.
- Change the position of the magnification window on the desktop.
- Invert the screen colors.
- Use a high-contrast setting.

Magnifier also has a number of tracking options, which include:

- Following the mouse pointer as it moves on the screen.
- Following the keyboard focus, which centers on the location of the cursor.
- Following text editing.

Familiar Accessibility Options Are Still There

The new utilities and enhanced features in Windows 2000 expand the array of accessibility options included in earlier versions of Windows.

A3 Appendix C: MCS VB Naming Conventions

Summary

It is a good idea to establish naming conventions for your Visual Basic code. This article gives you the naming conventions used by Microsoft Consulting Services (MCS).

This document is a superset of the Visual Basic coding conventions found in the Visual Basic "Programmer's Guide."

NOTE: The third-party controls mentioned in this article are manufactured by vendors independent of Microsoft. Microsoft makes no warranty, implied or otherwise, regarding these controls' performance or reliability.

More Information

Naming conventions help Visual Basic programmers:

- Standardize the structure, coding style and logic of an application.
- Create precise, readable, and unambiguous source code.
- Be consistent with other language conventions (most importantly, the Visual Basic Programmers Guide and standard Windows C Hungarian notation).
- Be efficient from a string size and labor standpoint, thus allowing a greater opportunity for longer and fuller object names.
- Define the minimal requirements necessary to do the above.

Setting Environment Options

Use Option Explicit. Declare all variables to save programming time by reducing the number of bugs caused by typos (for example, aUserNameTmp vs. sUserNameTmp vs. sUserNameTemp). In the Environment Options dialog, set Require Variable Declaration to Yes. The Option Explicit statement requires you to declare all the variables in your Visual Basic program. Save Files as ASCII Text. Save form (.FRM) and module (.BAS) files as ASCII text to facilitate the use of version control systems and minimize the damage that can be caused by disk corruption. In addition, you can:

- Use your own editor
- Use automated tools, such as grep
- Create code generation or CASE tools for Visual Basic
- Perform external analysis of your Visual Basic code

To have Visual Basic always save files as ASCII text, from the Environment Options dialog, set the Default Save As Format option to Text.

Object Naming Conventions for Standard Objects

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The following tables define the MCS standard object name prefixes. These prefixes are consistent with those documented in the Visual Basic Programmers Guide.

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	Object Type	Example
TEAMmethod 4.2	Copyright © 2000 Unisys Corporation 7/11/2001	

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ani	Animation button	aniMailBox
bed	Pen Bedit	bedFirstName
cbo	Combo box and drop down list box	cboEnglish
chk	Checkbox	chkReadOnly
clp	Picture clip	clpToolBar
cmd (3d)	Command button (3D)	cmdOk (cmd3dOk)
com	Communications	comFax
ctr	Control (when specific type unknown)	ctrCurrent
dat	Data control	datBiblio
dir	Directory list box	dirSource
dlg	Common dialog control	dlgFileOpen
drv	Drive list box	drvTarget
fil	File list box	filSource
frm	Form	frmEntry
fra (3d)	Frame (3d)	fraStyle (fra3dStyle)
gau	Gauge	gauStatus
gpb	Group push button	gpbChannel
gra	Graph	graRevenue
grd	Grid	grdPrices
hed	Pen Hedit	hedSignature
hsb	Horizontal scroll bar	hsbVolume
img	Image	imgIcon
ink	Pen Ink	inkMap
key	Keyboard key status	keyCaps
lbl	Label	lblHelpMessage
lin	Line	linVertical
lst	List box	lstPolicyCodes
mdi	MDI child form	mdiNote
mpm	MAPI message	mpmSentMessage
mps	MAPI session	mpsSession
mci	MCI	mciVideo
mnu	Menu	mnuFileOpen
opt (3d)	Option Button (3d)	optRed (opt3dRed)
ole	OLE control	oleWorksheet
out	Outline control	outOrgChart
pic	Picture	picVGA
pnl3d	3d Panel	pnl3d
rpt	Report control	rptQtr1Earnings
shp	Shape controls	shpCircle
spn	Spin control	spnPages
txt	Text Box	txtLastName

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tmr	Timer	tmrAlarm
vsb	Vertical scroll bar	vsbRate

Object Naming Convention for Database Objects

Prefix	Object Type	Example
db	ODBC Database	dbAccounts
ds	ODBC Dynaset object	dsSalesByRegion
fdc	Field collection	fdcCustomer
fd	Field object	fdAddress
ix	Index object	ixAge
ixc	Index collection	ixcNewAge
qd	QueryDef object	qdSalesByRegion
qry (suffix)	Query (see NOTE)	SalesByRegionQry
ss	Snapshot object	ssForecast
tb	Table object	tbCustomer
td	TableDef object	tdCustomers

NOTE: Using a suffix for queries allows each query to be sorted with its associated table in Microsoft Access dialogs (Add Table, List Tables Snapshot).

Menu Naming Conventions

Applications frequently use an abundance of menu controls. As a result, you need a different set of naming conventions for these controls. Menu control prefixes should be extended beyond the initial mnu label by adding an additional prefix for each level of nesting, with the final menu caption at the end of the name string. For example:

Menu Caption Sequence	Menu Handler Name
Help.Contents	mnuHelpContents
File.Open	mnuFileOpen
Format.Character	mnuFormatCharacter
File.Send.Fax	mnuFileSendFax
File.Send.Email	mnuFileSendEmail

When this convention is used, all members of a particular menu group are listed next to each other in the object drop-down list boxes (in the code window and property window). In addition, the menu control names clearly document the menu items to which they are attached.

Naming Conventions for Other Controls

For new controls not listed above, try to come up with a unique three-character prefix. However, it is more important to be clear than to stick to three characters.

For derivative controls, such as an enhanced list box, extend the prefixes above so that

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there is no confusion over which control is really being used. A lower-case abbreviation for the manufacturer would also typically be added to the prefix. For example, a control instance created from the Visual Basic Professional 3D frame could use a prefix of fra3d to avoid confusion over which control is really being used. A command button from MicroHelp could use cmdm to differentiate it from the standard command button (cmd).

Third-Party Controls

Each third-party control used in an application should be listed in the application's overview comment section, providing the prefix used for the control, the full name of the control, and the name of the software vendor:

Prefix	Control Type	Vendor
cmdm	Command Button	MicroHelp

Variable and Routine Naming

Variable and function names have the following structure:

<prefix><body><qualifier><suffix>

Part	Description	Example
<prefix>	Describes the use and scope of the variable	iGetRecordNext
<body>	Describes the variable	iGetNameFirst
<qualifier>	Denotes a derivative of the variable	iGetNameLast
<suffix>	The optional Visual Basic type character	iGetRecordNext%

Prefixes:

The following tables define variable and function name prefixes that are based on Hungarian C notation for Windows. These prefixes should be used with all variables and function names. Use of old Basic suffixes (such as %, &, #, etc.) are discouraged.

Variable and Function Name Prefixes:

Prefix	Converged	Variable Use	Data Type	Suffix
b	bln	Boolean	Integer	%
c	cur	Currency - 64 bits	Currency	@
d	dbl	Double - 64 bit	Double	#
		signed quantity		
dt	dat	Date and Time	Variant	
e	err	Error		
f	sng	Float/Single – 32	Single	!
bit signed				
floating point				
h	Handle	Integer		%
i	Index	Integer		%

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Prefix	Converged	Variable Use	Data Type	Suffix
l	lng	Long - 32 bit	Long	&
signed quantity				
n	int	Number/Counter	Integer	%
s	str	String	String	\$
u		Unsigned - 16 bit	Long	&
		unsigned quantity		
udt		User-defined type		
vnt	vnt	Variant	Variant	
a		Array		

NOTE: the values in the Converged column represent efforts to pull together the naming standards for Visual Basic, Visual Basic for Applications, and Access Basic. It is likely that these prefixes will become Microsoft standards at some point in the near future.

Scope and Usage Prefixes:

Prefix	Description
g	Global
m	Local to module or form
st	Static variable
(no prefix)	Non-static variable, prefix local to procedure
v	Variable passed by value (local to a routine)
r	Variable passed by reference (local to a routine)

Hungarian notation is as valuable in Visual Basic as it is in C. Although the Visual Basic type suffixes do indicate a variable's data type, they do not explain what a variable or function is used for, or how it can be accessed. Here are some examples:

iSend - Represents a count of the number of messages sent

bSend - A Boolean flag defining the success of the last Send operation

hSend - A Handle to the Comm interface

Each of these variable names tells a programmer something very different. This information is lost when the variable name is reduced to Send%. Scope prefixes such as g and m also help reduce the problem of name contention especially in multi-developer projects.

Hungarian notation is also widely used by Windows C programmers and constantly referenced in Microsoft product documentation and in industry programming books. Additionally, the bond between C programmers and programmers who use Visual Basic will become much stronger as the Visual C++ development system gains momentum. This transition will result in many Visual Basic programmers moving to C for the first time and many programmers moving frequently back and forth between both environments.

The Body of Variable and Routine Names

The body of a variable or routine name should use mixed case and should be as long as necessary to describe its purpose. In addition, function names should begin with a verb, such as InitNameArray or CloseDialog.

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For frequently used or long terms, standard abbreviations are recommended to help keep name lengths reasonable. In general, variable names greater than 32 characters can be difficult to read on VGA displays.

When using abbreviations, make sure they are consistent throughout the entire application. Randomly switching between Cnt and Count within a project will lead to unnecessary confusion.

Qualifiers on Variable and Routine Names

Related variables and routines are often used to manage and manipulate a common object. In these cases, use standard qualifiers to label the derivative variables and routines. Although putting the qualifier after the body of the name might seem a little awkward (as in sGetNameFirst, sGetNameLast instead of sGetFirstName, sGetLastName), this practice will help order these names together in the Visual Basic editor routine lists, making the logic and structure of the application easier to understand. The following table defines common qualifiers and their standard meaning:

Qualifier	Description (follows Body)
First	First element of a set.
Last	Last element of a set.
Next	Next element in a set.
Prev	Previous element in a set.
Cur	Current element in a set.
Min	Minimum value in a set.
Max	Maximum value in a set.
Save	Used to preserve another variable that must be reset later.
Tmp	A "scratch" variable whose scope is highly localized within the
code.	The value of a Tmp variable is usually only valid across a set of contiguous statements within a single procedure
Src	Source. Frequently used in comparison and transfer routines.
Dst	Destination. Often used in conjunction with Source.

User Defined Types

Declare user-defined types in all caps with _TYPE appended to the end of the symbol name. For example:

```
Type CUSTOMER_TYPE
    sName As String
    sState As String * 2
    IID as Long
End Type
```

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When declaring an instance variable of a user defined type, add a prefix to the variable name to reference the type. For example:

```
Dim custNew as CUSTOMER_TYPE
```

Naming Constants

The body of constant names should be UPPER_CASE with underscores (_) between words. Although standard Visual Basic constants do not include Hungarian information, prefixes like i, s, g, and m can be very useful in understanding the value and scope of a constant. For constant names, follow the same rules as variables. For Example:

```
<mnUSER_LIST_MAX ' Max entry limit for User list (integer value,  
                  ' local to module)  
  
gsNEW_LINE      ' New Line character string (global to entire  
                ' application)
```